SCIENTIFIC AMERICAN

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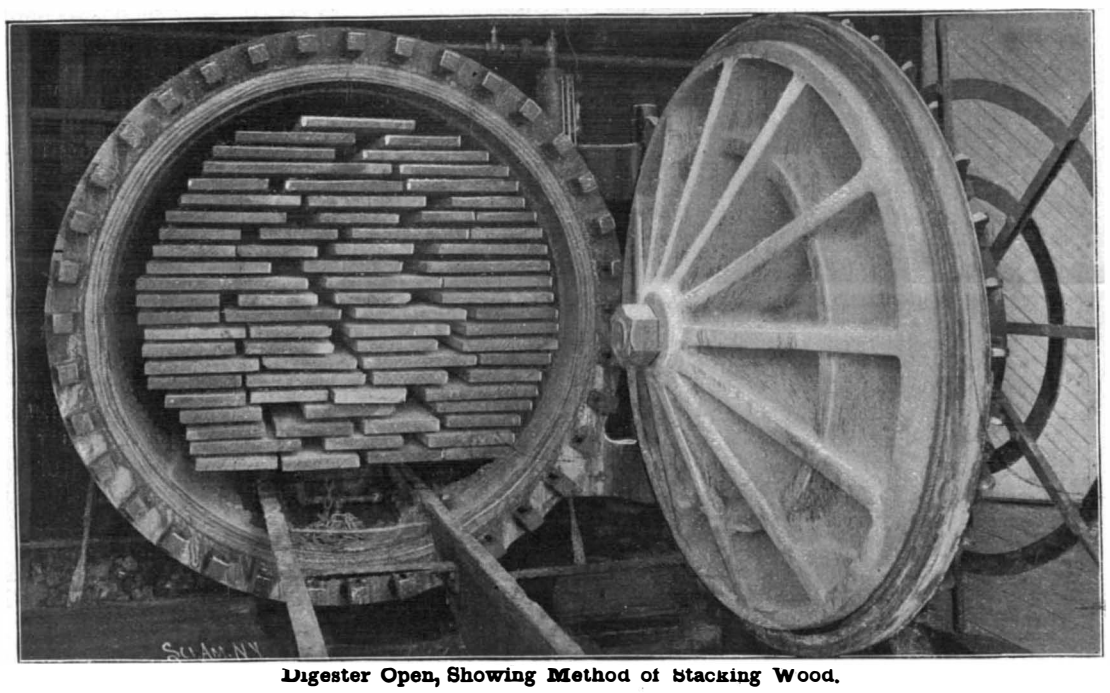
## PLANT AND PROCESS FOR FIREPROOFING WOOD.

During the past year there were two tragic events, resulting from sudden and unexpected conflagrations, which made a profound impression, not merely on the countries concerned, but throughout the world at large. One of these was the swift destruction by fire, due to the shells of the American warships, of the Spanish cruisers engaged in the battle of Santiago, and the other was the awful conflagration by which the Windsor Hotel, in this city, was wiped out of existence with an attendant loss of nigh upon half a hundred lives. Although neither event taught the world anything that it did not know before, they both impressed deeply the lesson of the perils which are involved in the extensive use of wood as a material of construction where the risk of fire is aggravated and ever present. It has been commonly supposed that the Spanish ships contained a larger amount of woodwork than is usually found in warships constructed at the same date as themselves. As a matter of fact, however, they carried in the shape of decks, bulkheads, and partitions, no more woodwork, and indeed, not so much, as is usually found in cruisers that were built about the year 1890. So far from the conditions being favorable for such a rapid conflagration as took place, they were actually unfavorable. The decks were largely protected on their under side by the deck beams, stringer plates and diagonal strapping, so that not only was the amount of under surface exposed to fire greatly reduced, but the large amount of ironwork in close contact with the overlying decks would, by conducting the heat rapidly away, tend to retard combustion. Yet it is a fact that these vessels had not been many minutes under fire before our shells had set them so fiercely ablaze that before the Spanish batteries had been disabled, it was necessary to run the vessels ashore in the effort to save the lives of the crews.

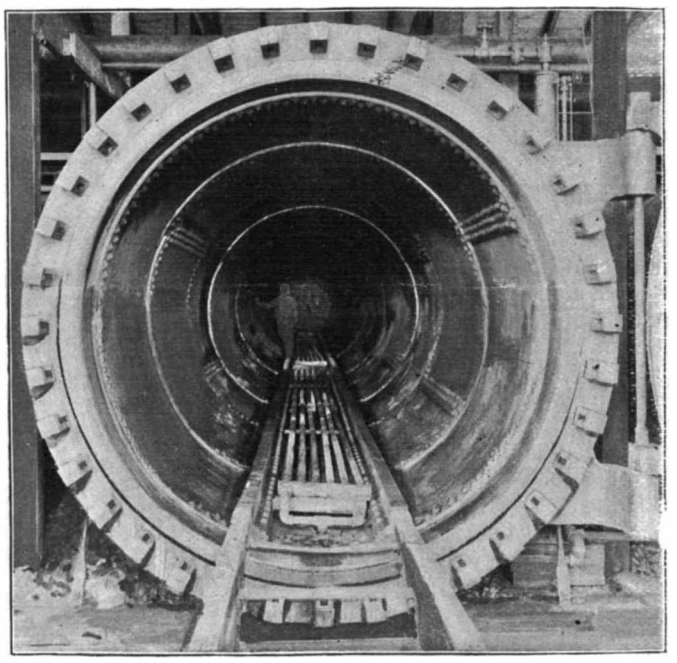
Blowpipe Test.

Naval men had been well aware, previous to the battle of Santiago, of the extreme peril involved in the presence of inflammable wood in the construction of warships, for at the battle of Yalu the Chinese gunners spent more time in putting out fires than in serving their batteries. The lesson suggested at Yalu received such a power of indorsement at Santiago and Manila that it is safe to say that every ship designed since the date of the Spanish war will be provided with as little wood-

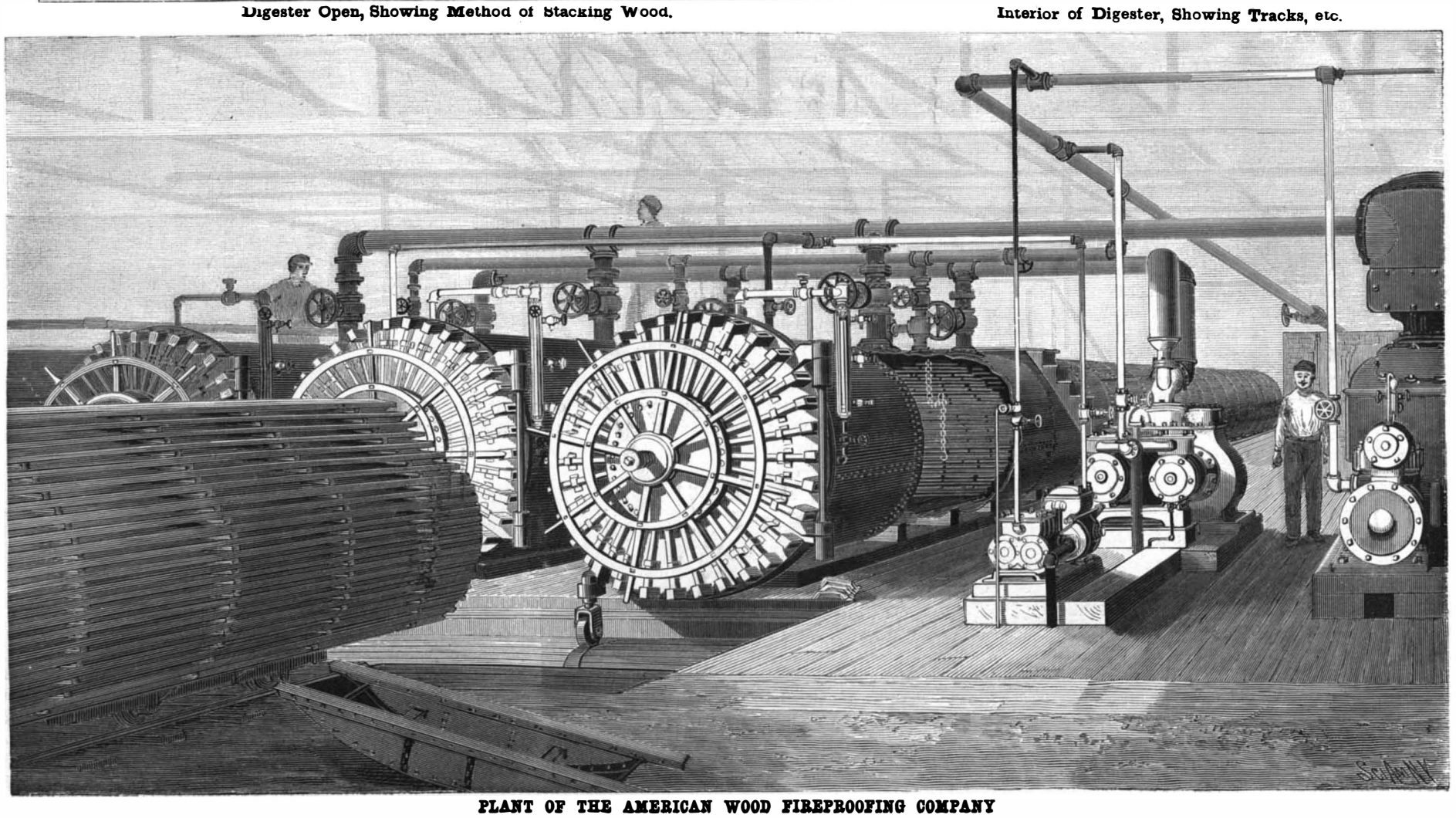
(Continued on page 198.)



Digester Open, Showing Method of Stacking Wood.



Interior of Digester, Showing Tracks, etc.



PLANT OF THE AMERICAN WOOD FIREPROOFING COMPANY

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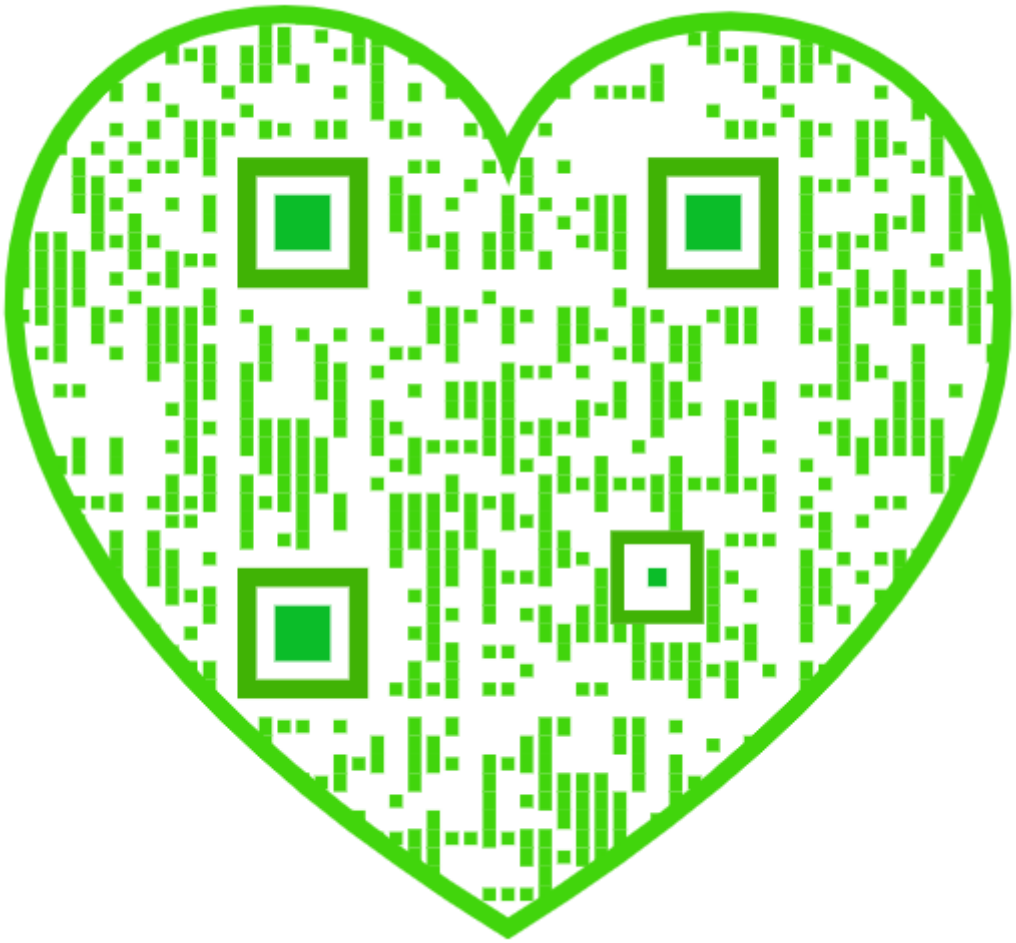

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NEW YORK, SATURDAY, SEPTEMBER 23, 1899.


## THE "OCEANIC."

The advent of the "Oceanic" to our port marks a new stage in the history of steamship construction. It introduces a true marine giant, as will be seen from the fact that the "Oceanic" is over fifty per cent larger than any of the huge vessels which have been launched in the past decade, and therefore constitutes in respect of size a class by herself. The largest vessel afloat, previously to the launch of the "Oceanic," was the "Kaiser Wilhelm der Grosse" of the North German Lloyd Company, whose full load displacement is 20,000 tons. The White Star liner, however, has been built to take advantage of the new 40-foot channels which are being dredged in New York Harbor, and on her full load draught of 35 feet 7 inches she will displace, according to the builders' calculations, 31,590 tons. It was stated by the officers of the ship that a cargo and passenger-carrying vessel of even larger dimensions, built on the lines of the "Cymric," is now under way at the Belfast yards. It is likely that the twentieth century will witness the construction of Atlantic liners whose mark will be set by this great ship of the year 1899. In view of the many contradictory statements as to the horse power and speed of the "Oceanic," we have ascertained from the officials directly concerned in her construction that on her trial trip she made 21·25 knots with an indicated horse power of 28,000 and a boiler pressure of 192 pounds to the square inch. For those of our readers who may not have an opportunity to see the "Oceanic," an excellent scale of measurement is afforded by the fact that from the top of her 19-foot smokestacks to the grate bars of the furnaces is 139 feet.

## FINANCIAL PROBLEMS OF CUBA.

Figures just compiled by the War Department give a most encouraging tone to the financial problems of Cuba. Already, under the liberal and intelligent management of the United States government, the total income of the island, for the first six months of this year, exceeds all expenditures by the very handsome balance of $1,480,021.92. No doubt, this news will greatly surprise very many, who have hardly looked for such a result from a purely army management of affairs; as too many are apt to imagine that laxity, extravagance, and an absence of business methods are characteristic of military methods. As a matter of fact, this idea is based on a great misconception of the truth. During the period named the total receipts were $6,982,010.20, and the disbursements $5,501,988.28. Of the latter sum $1,712,014.20 was expended in sanitation, an outlay such as Cuba never dreamt of in Spanish days; $505,263.06 in the erection or improvement of barracks and army quarters; $443,563.19 in establishing and maintaining the rural guard of the island; $250,674.12 on public works; $293,881.27 for charities and hospitals; $242,146.01 for civil government; $723,281.38 in municipal management; $88,944.03 in aid of quarantine affairs. When we consider that, notwithstanding the report for July shows an even greater proportionate saving, it has been possible thus far this year to expend nearly one-half the total in those things which make for greater physical and moral cleanliness, altruistic endeavors largely neglected hitherto in Cuba, this showing is especially gratifying to our national pride. It is easy, in view of these facts, to understand why British capital is pouring into Cuba for investment, assured as it is of a stable, honest, and far-seeing rule for that sadly abused island.

## MONEY SPENT BY TRAVELERS.

Few have any conception of the enormous outgo of money earned in this country and spent by our leisure and traveling classes in Europe each year. It is now proposed, according to a chief of one of the Treasury bureaus, in Washington, to compile an accurate set of statistics upon this subject. Several years ago such an effort was made, but it was not carried out as thoroughly as it should have been. Even then, however, the total ran up to over $230,000,000 before the work was abandoned. It is promised now that the forthcoming investigation will be very thorough, including as it will data from steamships, railroads, custom houses, consular estimates, reports of special foreign agents, etc. Such statistics cannot fail to have great interest and value to students of political economy and, especially, to all interested in the problems of the distribution of taxation.

## DANGER IN THE APPROACHES TO THE BROOKLYN NAVY YARD.

The disastrous grounding of the "Massachusetts" and the "Brooklyn," both of which occurred during the past twelve months, have drawn attention to the fact that a visit on the part of any of the deep draught vessels of the navy to the Brooklyn navy yard is fraught with positive danger, particularly at certain stages of the tide. In the case of the "Massachusetts," the existence of the shoal off Governor's Island was well known to the authorities, but the accident to the "Brooklyn" was in the nature of a surprise, for it was supposed that there was ample depth of water at the spot where she was supposed to have touched bottom. In the course of a survey made by the Coast and Geodetic Survey boat "Eagle," it has been found that the obstruction consisted of a sunken barge that lay about 200 yards out from the Hamilton Ferry slip in 30 feet of water.

It appears that this is not the spot on which the barge was sunk, the wreck having been carried there by the powerful tidal currents that sweep through the channels in this vicinity; and it is this very liability of a sunken and semi-buoyant wreck to be shifted that renders it such a menace to the safety of vessels of the deep draught of our battleships and larger cruisers. The War Department cannot do a greater service to the sister arm of the service than by making a thorough survey of the approaches to the Brooklyn navy yard and presenting a comprehensive scheme for clearing the channels and deepening them to an extent that will allow our battleships to leave and enter the yard at any state of the tide. Our two latest battleships are about to pass through these channels to prepare for their trial trips, and it would be a humiliating mortification if they should open their careers with accidents which are of such a nature that they might easily become disasters.

## NEW WAYS OF USING THE BIG CORN CROP.

The corn carnival is the feature of the great valleys of the Central West "when the frost is on the pumpkin and the corn is in the shock," but with a crop of some 300,000,000 bushels to harvest there are tired souls and wearied bodies in the corn belt these fine autumn days. The promise of wealth and abundance of this world's goods brings consolation and joy; it is the prolonged labor without the monetary compensation that disheartens and dispirits. Never was there a more propitious corn carnival season than the present, and Kansas and the corn belt are jubilant. Crops are good, and prices are good. Corn is everywhere and everything. One cannot walk the streets of a Kansas town to-day without encountering witnesses of the State's wealth. There are corn neckties in the show-windows, corn-husk parasols and hats in the possession of fair women pedestrians, cornstalk canes jauntily swung by prosperous swains, and corn shoes and dolls for children everywhere. The manifold value of corn for household and personal adornment has been the feature of each succeeding carnival, and this year's creations have totally eclipsed anything heretofore witnessed.

But while the carnival emphasizes the ornamental side, there is an undercurrent of seriousness about this adaptation of corn and its by-products that more deeply concerns the people than an outsider might imagine. Corn was never used in so many different ways for commercial and manufacturing purposes as in the past year or two. If we cannot induce the Europeans to take our corn for household uses, we can manufacture it into different articles of commercial value which they must take. This seems to be the trend of thought in the corn belt, and new inventions and discoveries annually open up new consumptive markets for corn and its products. Corn is gradually entering into industries that seem far removed in every sense from this product of the fields. The queer corn shoes, corn hats, dolls, and neckties which were made and exhibited for celebrating the corn carnival stand in sharp contrast with the corn oil, corn cakes, and corn rubber.

The one hundred and twenty-odd recipes for using corn as an article of food, which government experts published ten years ago for the benefit of benighted Europeans who did not appreciate this article of food, are not so important in increasing the consumptive demand as some of the recent discoveries. Corn oil for instance, which is extracted from the grain, has an extensive demand in various trades where vegetable oils are essential. Corn oil can be produced more cheaply than most of our vegetable oils because of the relative abundance of corn, and in the last year much of the oil has been used for table purposes. No attempt has been made to substitute for good olive oil, but judiciously mixed it will pass muster as a low grade table oil. It is also a fair lubricating oil; but its largest use is in the trades and manufactures. Paint mixers employ it quite generally, and also manufacturers of fiber and shade cloth. It possesses qualities that recommend it particularly to these industries, and the demand for it is annually increasing.

Corn rubber is a new article which is substituted for pure rubber in certain lines of goods. This cheap substitute is mixed with equal parts of pure Para rubber. The corn part of the substitute is taken from the refuse of the glucose factory. About five per cent of the corn in making glucose could not formerly be utilized, and this waste seemed absolute. The new corn rubber is manufactured from this apparent waste, and when mixed with pure rubber it produces an especially valuable compound. Improvements in this rubber substitute are made each year, and it has to a certain extent supplanted Para rubber for many purposes. This imitation rubber is from 25 to 50 per cent cheaper than pure rubber, but it has not been sufficiently perfected entirely to displace the Para article. The oil which is found in corn gives a pliability to the rubber compound that prevents it from cracking and breaking as most cheap grades of rubber do. Moreover, the oil of corn tends to prevent the rubber from oxidizing, a fault common to most India rubber.

There are five refineries of corn oil in the United States which use between 10,000,000 and 20,000,000 bushels of corn and corn waste. Besides the output of oil, the refineries have made nearly thirty other different products from the corn. But in spite of all these various products about 5 per cent was practically waste until the discovery of the rubber substitute was made. The spirits distilled from corn constitute another large industry, and recently the employment of the spirits in the manufacture of new grades of smokeless powder has greatly increased the demand for corn. The British government has been a liberal buyer of the spirits for this purpose, and the Japanese government has quite recently placed an order for several thousand barrels for the same purpose. An extensive European war would consequently send the price of corn "booming," because of its general need for food and because it would be in demand for the manufacture of large quantities of smokeless powder. The distilling companies are not only increasing in number, but the output of the largest is doubling. They absorb an enormous quantity of the farmer's corn and prevent a surplus that might otherwise reduce prices below the point of profit for the growers.

The comparatively new cattle foods owe their existence to the employment of corn in various manufacturing purposes. All of them have received scientific tests and the indorsement of experts in cattle feeding. The corn oil cake, which is really the refuse of factories, contains nutriment of a high order, and when properly fed, in conjunction with other foods, it is of great value to the animals and money in the pocket of the farmer. Gluten meal, gluten feed, and chop feed are other cattle foods that owe their origin to the different factories employed in converting corn into products of commercial and scientific use.

The manufacture of glucose has opened up a whole field of new industries, and the glucose made from corn enters quite extensively into the refining of syrups, jellies, and fruit preserves. It is also used by leather tanners and brewers. The sugar and starch made from corn form other branches of important industries. Different grades of grape sugar are made from the corn, and they are used by ale brewers and tanners, while the better grades are employed by apothecaries and confectioners. Pearl and powdered starch come from the corn, and also dextrin and flourin. The former is employed in the manufacture of mucilage and glue, and the latter is mixed with flour. The new uses to which these by-products of corn are put multiply rapidly, and every new employment of any of them makes a greater demand upon the corn crop. It is all along this line that improvements are being made which encourage the corn farmers and improve the future for them. If it were not for these several dozen different articles which are made from corn, the farmers of the corn belt would long since have been ruined. A crop of 300,000,000 bushels would simply swamp them, and make corn so cheap that it would not pay to harvest it. But with this enormous crop in view, the farmers are happy and jubilant, because there is sufficient demand for the product to keep the prices up.

## WIRELESS TELEGRAPHY TO REPORT THE YACHT RACES.

The New York Herald has made arrangements for the exclusive use of the Marconi system of wireless telegraphy for reporting America's cup races off Sandy Hook. Signor Marconi and four assistants have sailed from Liverpool with all the necessary instruments for use in reporting the races, and the work will be done under the personal supervision of Marconi and his assistants, who have been engaged in experiments on

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the transmission of wireless dispatches across the British Channel during the last six months.

The instruments will be placed on the "Grande Duchesse," of the Plant line, upon the upper deck of which a tall pole, extending 60 feet in the air above the water line, will be placed, and a running account of the races will be telegraphed by Marconi and his assistants. On board the cable ship anchored near Scotland light a similar pole will be erected, and here two expert operators will be stationed to receive the message after it has been transmitted from the "Grande Duchesse." From the cable ship the message will be transmitted by means of submarine and land wires. The steamer "Ponce" will also be equipped with wireless telegraphy apparatus, the system of Mr. W. J. Clarke being used.

Rear-Admiral Bradford, Chief of the Bureau of Equipment of the Navy Department, has been informed that Signor Marconi will go to Washington to discuss with him the proposed experiments with wireless telegraphy. Admiral Bradford will recommend that one of the vessels of the navy be set aside for experimental work. It is proposed to place the receiver on shore, and the warship will communicate with it from varying distances. By this means it is believed the system will be developed and the value of it will be definitely determined.

## SOME CALENDARIAL FACTS ABOUT THE TWENTIETH CENTURY.

When will the twentieth century begin? Why there should be different answers to this question is a little puzzling to know. A few fundamental facts disposed of, ought easily to settle the controversy. Of course, the first century began with the year 1, and closed with the year 100. The second century, then, began with the year 101, and closed with the year 200. Now, following this method to the present time, there can be but one answer to the above question. The nineteenth century closes with the year 1900, and the year 1900 closes December 31. Immediately after midnight, therefore, of December 31, 1900, is when the twentieth century begins. In other words, it begins with the first second of the first hour of the first day of January, 1901.

Just at the very nick of time when the twentieth century begins at the international date line, the nineteenth will still be enveloping, as it were, the entire globe; but twelve hours afterward, it will be the twentieth century on half the earth and the nineteenth on the other half; twelve hours later the nineteenth will have entirely passed, and the twentieth will have made its first circuit round this ball on which we live. Thus it takes a century a full day's time to get complete possession of affairs, and from the time of its very beginning to the point where its last trace disappears occupies just 100 years and 1 day. This is evident from the fact that after a new century has begun on the earth, it still takes the preceding century full twenty-four hours to give way entirely to the new.

The twentieth century will open on Tuesday and close on Sunday. It will have the greatest number of leap years possible for a century—twenty-four. The year 1904 will be the first one, then every fourth year after that to and including the year 2000. February will three times have five Sundays; in 1920, 1948 and 1976. In 1901, Decoration Day, Fourth of July and Thanksgiving Day will occur the same day in the week. Then, after that, the same thing will happen at the following intervals: 6, 11, 11, 6, 11, 11, and so on, years; or in 1907, 1918, 1929, 1935, and so on. In the years 1912, 1940, 1969 and 1996, there are four holidays that will fall on the same day in the week: the three already mentioned and Washington's Birthday Anniversary, as also the 29th of February. Thanksgiving Day and Christmas will occur on the same day in the week in 1906, and then at successive intervals of 11, 6, 11, 11, 6, 11 years, and so on; also in 1928, 1956 and 1984. March 4 will fall on Sunday in the inaugural years 1917, 1945, and 1973.

The same yearly calendar that was used in 1895 can be used again in 1901, after which, at successive intervals of 6, 11, 11 years throughout the century; that for 1890 again in 1902 and at intervals of 11, 6, 11 years; 1891, again in 1903 and at intervals of 11, 11, 6 years; 1892, in 1904 and at intervals of 28 years; 1899, in 1905 and at intervals of 6, 11, 11 years; 1894, in 1906 and at intervals of 11, 6, 11 years; 1896, in 1908 and every 28th year thereafter; 1897, in 1909, and at intervals of 6, 11, 11 years; 1898, in 1910, and at intervals of 11, 6, 11 years; 1872, in 1912 and every 28th year thereafter; 1876, in 1916; 1880, in 1920; 1884, in 1924; 1888, in 1928; in the last four cases, also at intervals of 28 years.

The following are, in order, beginning with 1901, the dates of Easter for the first 25 years of the century; April 7, March 30, April 12, 3, 23, 15, March 31, April 19, 11, March 27, April 16, 7, March 23, April 12, 4, 23, 8, March 31, April 20, 4, March 27, April 16, 1, 20, 12.

The earliest possible date on which Easter can occur is March 22. The last time it occurred on this date was in 1818, but it will not occur again till after the twentieth century. The latest Easter can occur is April 25, and it will thus occur but once in the coming century, in 1943. Whenever Easter occurs on March 27, or April 3, 10, 17, or 24, Christmas also occurs on Sunday. Though one of the objects aimed at by the church authorities who fixed upon the method of determining the date of Easter was to prevent its occurrence on the same day as the Jewish Passover, nevertheless the two events will occur together four times in the twentieth century, April 12, 1903, April 1, 1923, April 17, 1927, and April 19, 1981.

The twentieth century will contain 36,525 days, which lacks but one day of being exactly 5,218 weeks. The middle day of the century will be January 1, 1951. The day of the week that will not occur as often as each of the others is Monday. Fifteen out of the hundred years will begin on Wednesday and the same number on Friday. Fourteen will begin on each of the other days in the week.

The following is a special rule for finding the day in the week corresponding to any date of the twentieth century: Add together the number of the year of the century, one-fourth of one less than this number, neglecting fractions, and the number of the day in the year; increase this sum by 1, and then divide by 7. The remainder will indicate the number of the day in the week, Sunday being regarded as 1 and Saturday as 0. Thus in the case of July 4, 1980, we have as the number of the year of the century, 80; as one-fourth of one less than this number, 19; and as the number of the day in the year, 186, the year being a leap year. Hence, $80 + 19 + 186 + 1 = 286$, which divided by 7 gives 6 as a remainder. The day in the week is, therefore, Friday.

Several announcements are made of changes to be inagurated with the opening of the new century. The first of importance is that Russia will adopt the Gregorian calendar. This will be done by omitting thirteen days, the amount of error that will have accumulated after the close of February, 1900. The Russians will then write January 1, 1901, instead of December 19, 1900, or rather instead of $\frac{\text{December 19, 1900}}{\text{January 1, 1901}}$ the dual system now in vogue in that country and in Greece. The other important announcement is that it is not at all unlikely that the astronomical day, which now begins at noon of the civil day, will begin with the civil day, at midnight. The present method of having the astronomical day to begin twelve hours after the beginning of the civil day is apt to be confusing. On the other hand, to have the former begin at midnight, just when astronomers are often busiest, will be to them somewhat inconvenient.

As to eclipses in the coming century, there will be about 380 of them, the number of solar being to the number of lunar in about the ratio of 4 to 3. What is of very rare occurrence in a calendar year will happen in 1935, the first time since 1823, viz., seven eclipses, the largest possible number that can happen in a year. There are eight total solar eclipses predicted to occur, visible in the United States, in 1918, 1923, 1925, 1945, 1954, 1979, 1984, 1994. There will also occur twelve transits of Mercury, on the following dates: November 12, 1907; November 6, 1914; May 7, 1924; November 8, 1927; May 10, 1937; November 12, 1940; November 13, 1953; November 6, 1960; May 9, 1970; November 9, 1973; November 12, 1986; November 14, 1999. The first, second, ninth and tenth will be wholly visible in the United States; the seventh and eighth only partially so. A transit of Venus, however, which is of much more consequence, will not occur within the next century. The earliest date predicted is June 8, 2004.

While it is claimed at least a thousand comets come within visible range of the earth within a century, there is reasonable certainty of the recurrence of but one extraordinarily conspicuous comet in the next century. That one is known as Halley's. It was last seen in 1835. It will be due again in 1910 or 1911; the exact time is not known, owing to slight modifications in its orbit due to planetary influence. It will probably recur again sometime near 1985. Of course, it is not impossible for some hitherto unobserved comet to appear in all its blazing glory at any time. No astronomer knows. Of famous meteoric showers there will probably be the three recurrences of the Leonids, in 1932, 1965, and 1998, as in the present century, one being yet due, November 13 of this year.

BENJAMIN F. YANNEY.

## NEWS OF LIEUT. PEARY.

The Peary-Harmsworth steamer "Windward" has arrived at Brigus, Newfoundland, from Etah, North Greenland, and she will be followed by the "Diana" of the Arctic Club, in about a week. The two steamers met at Etah August 12, and worked in company under the direction of Lieut. Peary in collecting supplies for the winter and the equipment for next spring's campaign. Lieut. Peary and the sled parties were in the field almost continually from October, 1898, until August 6 of this year, and have effected an extraordinary amount of important work, adding much to the geographical knowledge of the coast line and to the interior of Ellesmere Land. The sledging journeys aggregated more than 1,500 miles. Lieut. Peary made a careful reconnoissance of the coast line southwest of Allman Bay, and carefully defined the lands between that point and Cape Sabine. The "Windward" was icebound in Allman Bay on the west side of Kane Basin from August, 1898, to August 2, 1899. Lieut. Peary made several very successful hunting trips and in December he sledged 250 miles north to Fort Conger, the headquarters of the Greely expedition. He had the misfortune to have both his feet frostbitten, which caused six weeks' delay and confinement until he could make the return trip.

He was hauled all the way back to the "Windward" where several toes were amputated. This was followed by complete recovery, and he now walks as well as ever. Peary was the first to visit Fort Conger since Greely left it in 1883. He brought away and is sending home the original Greely records, the sextant of the Nares-Markham expedition of 1876–78, and many private letters and papers of members of the Greely party. The records can only be regarded as relics, as Gen. Greely had brought three copies of them to the United States. Lieut. Peary also conducted a reconnoissance beyond Fort Conger to Cape Beechey. Subsequently he made a second trip to Fort Conger, and four parties in all reached that point from the "Windward."

The winter is now settling down over his camp at Etah on the Greenland coast east of Smith Sound. It is a good place for a camp and is near the one where Dr. Hayes wintered in 1886. Peary has built a comfortable living and working room for himself and his companions, and during the winter he will collect more dogs for next season's campaign and prepare to resume his sledge work up the channels from Smith Sound as soon as the sun returns. The winter will be spent in rest and in working up the results of last year. The "Fram" wintered near Cocked Hat Island 10 miles west of Cape Sabine. She was released from the ice August 1, and reached Etah August 12, and left the same day for Cape Sabine. It is reported she will go to Jones Sound for the winter, unless she succeeds in getting beyond Kennedy Channel and landing Captain Sverdrup for a sledge trip across or around the northern end of Greenland, to be picked up on the east coast by the ship "Windward."

## OBSERVATIONS OF POLARIS.

Prof. W. W. Campbell, on September 12, made the following statement in regard to his recent observations, by means of which he discovered that Polaris, familiarly known as the North Star, embraces three distinct bodies:

"The observations of Polaris," says The New York Times, "were made with the Mills spectroscope attached to the 36-inch telescope. From the well-known principle of the shifting of the line in the spectrum of a star, we can determine whether the star is approaching or receding from the observer and how rapidly. For most stars the velocity is constant. For some stars the velocity is variable, due to the attractions of companion stars.

"The recent observations of Polaris, at Lick Observatory, show that its velocity is variable. It is approaching the solar system now with a velocity of 8 kilometers per second. This will increase in two days to 14 kilometers, and in the next two days will decrease again to 8 kilometers. This cycle of change is repeated every four days. The bright Polaris, therefore, revolves about the center of gravity of itself and its invisible companion once in four days. The orbit is nearly circular and is comparable in size with the moon's orbit around the earth.

"This center of gravity, and therefore the binary system, is approaching the solar system at present with a velocity of 11½ kilometers per second. A few measures of the velocity of Polaris made here in 1896 gave its approach at the rate of 20 kilometers per second. Part of this change since 1896 could be due to a change in position of the orbit of the binary system, but most of it must have been produced by the attraction of a third body on the two bodies comprising the four-day system. The period of revolution of the binary system around the center of gravity of itself and the third body is not known, but is probably many years.

"Both companions of Polaris are invisible, but their presence is proved by disturbances which their attractions produce in the motion of the bright Polaris."

## GOVERNMENT AID IN FORESTRY.

The Division of Forestry, of the United States Department of Agriculture, has issued a circular stating that the division is prepared, as far as a limited appropriation will permit, to render practical and personal assistance to farmers and others by co-operating with them to establish forest plantations, wood lots, shelter belts, and wind breaks. An expert tree planter will have charge of the work, and he will be assisted by collaborators from the different States who are familiar with local conditions. It is proposed that visits be made by the superintendent or one of his assistants to the lands of the farmers desiring aid in forestry, and that working plans be given, including help in the selection of trees, information about planting, and instruction in handling forest trees after they are planted.

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### A SAN FRANCISCO FIRE FIGHTER.

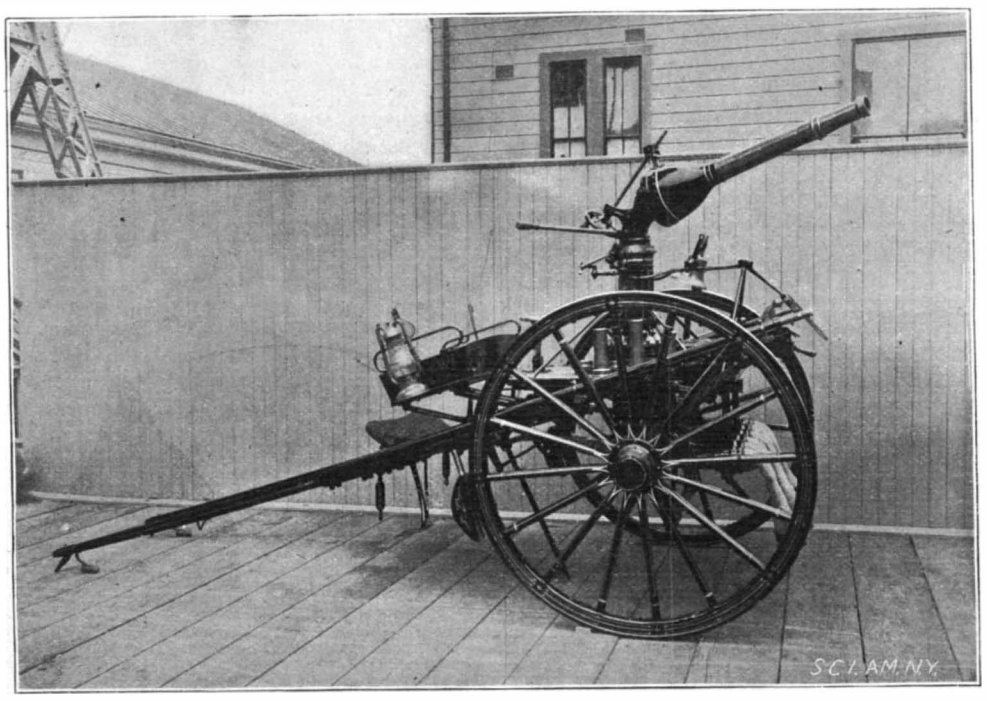
BY HERBERT I. BENNETT.

The San Francisco Fire Department has in its service a machine bearing somewhat the appearance of a small cannon mounted on two wheels. Instead of pouring out shot and shell like the latter, the machine in question, however, does pour a great volume of water on a fire with telling effect. This piece of apparatus is known as the Monitor Battery, and was invented by Mr. H. H. Gorter, constructor for the San Francisco Fire Department. It is designed to take the place of a water tower in small confines where the latter cannot be taken and can be used in a basement blaze and up to a fourth story inclusive. Several lines of hose are connected, thus concentrating a great force of water that is easily handled by one man.

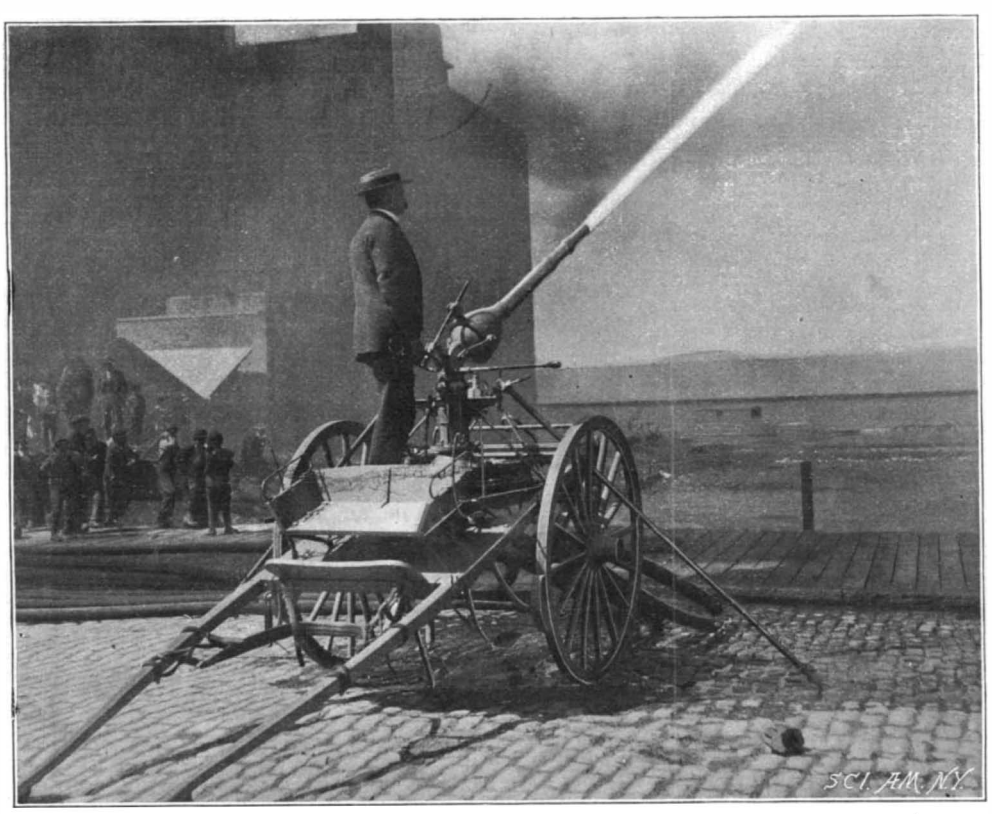
The nozzle is provided with tips so that either a 2, 2¼, 2½, 2¾ or a 3-inch stream can be thrown. When not in action, the table upon which rests the huge nozzle is suspended so as to throw the weight on the wheels and relieve the horse of the strain. When required for action, the table is released by a lever which throws it forward to a level, at the same time moving the center of gravity forward. The weight is thus thrown between the toes at the end of the shaft and the axle, giving the machine stability to withstand a back pressure of fifteen hundred pounds to the square inch. The toes referred to are spikes under the end of the shaft for the purpose of obtaining a purchase in the ground to prevent moving.

The vertical movement of the nozzle is on an improved ball and socket joint, allowing a free flow of water at any angle. A roller bearing is provided for traveling the nozzle through a horizontal arc which reduces the friction caused by back pressure to a minimum. On the rear end are six short flexible connections or pieces of hose for connecting the battery with the various lines of hose leading from the engines. When not in action the connections are suspended beneath the rear end of the apparatus. They are automatically released by the tilting of the table when required for service. The tilting of the table also releases a strut or brace which assists in relieving the strain on the shaft and frame due to back pressure from the nozzle.

The total weight of the battery complete is 1,650 pounds, and owing to its construction and free waterway, a solid stream is thrown ranging from 200 to 300 feet, according to the pressure. The nozzle with its tremendous pressure can, as before stated, be easily handled by one man, who guides it with a small lever. At the Baldwin Hotel fire, two batteries kept the blaze under control on the Market Street side, showing their value in cases of large conflagrations. They are splendid for handling big lumber fires also. From a point of economy, the machine deserves mention too, because it requires but one man and one horse, whereas a water tower takes three men and three horses to operate it. The inventor intends to make them automobiles in the near future.




THE GORTER "BATTERY" UNLIMBERED FOR ACTION.




A SAN FRANCISCO FIRE FIGHTER—THE "BATTERY" IN ACTION.

### Moving Millions of Gold.

Bigger heaps of gold than ever were buried by Capt. Kidd, or carried by rakish craft in the palmy days of the Spanish Main, are week in and week out hauled around New York city, to and from banks and steamship wharves, in a commonplace truck.

The business of moving the gold used in the settlement of commercial balances is always active in New York, for the credits and debits between the local banks, and, in a wider sense, between the United States and foreign countries, are daily shifting and must constantly be met, says The Saturday Evening Post. Of course a growing share of the exchanges between banks is made by the check system and the clearing house, so that after the associated banks, by their representatives, have met together in the morning of each business day and exchanged the checks on each other taken in the previous day's transactions, only the differences have to be paid in actual money.

Thus it happens that the actual exchange of cash is generally less than 10 per cent of the total clearings, or exchanges of checks. For example: One day recently, when the New York banks had the largest clearings ever recorded—more than $352,000,000—all that immense sum was paid and received by the use of only $15,000,000 of actual money. Ordinarily, this money would have been in the form of greenbacks, but for some months bills have been very scarce, and clearing-house balances have uniformly been paid in gold, as are foreign balances.

When the balance of trade demands actual shipments, New York bankers or foreign exchange houses call in the services of Mr. Barkley, a rotund truckman well known to everybody in Wall Street. He has a monopoly of the trucking of gold there; all the bankers know and trust him, as they did his father for more than forty years. Barkley has a slate hanging in a doorway near the Stock Exchange, and his trucks stand near by when not busy. The bankers send a clerk or messenger for Barkley when they want any carting done. The last time I passed that door the slate said, "Call at J. P. Morgan & Company's and see Mr. King." Another day it may contain one or half a dozen orders from the big houses, and thither Barkley or one or two of his men go to do their bidding.

Gold in transit is packed into small rouleaux, wrapped carefully in little canvas bags. The small bags are incased in bigger and heavier ones. The whole thing is then put into a small keg and the interstices are filled with sawdust. This is to prevent abrasion, for gold that is much worn by rolling around loses considerably in value.

Some gold stays in its wrappings for months and years together. It may in that time have traveled a dozen or twenty times across the ocean, or it may have lain untouched in bank vault or clearing-house. When moved about on the trucks, it might be supposed that a big guard of men would be necessary to watch lest some agile thief get away with one of the little kegs. But the little kegs are their own protection; the $60,000 they contain makes troublesome lifting for two men, and only a Sandow of a thief would have any chance to get away in safety.

When Barkley or his European confreres bring a consignment aboard, it is carefully stored in the ship's vault, and the purser takes sole charge of the keys. The first officer of the vessel sees that the vault is covered fathoms deep with the solidest kind of freight. If any robberies have occurred, they have never been recorded.

### The Ebony of the Ancients.

Ebony was known and highly esteemed by the ancients as an article of luxury, and was used by them for a variety of purposes, says The Jeweler's Weekly. In India, it is said that it was employed by kings for scepters and also for images. On account of its supposed antagonism to poisons, it was used largely for drinking cups. Its use has extended continuously down to the present time, and in England, as well as on the Continent, it has always been held in high esteem by the wealthy for toilet articles and boxes. In France particularly, the manufacture of ebony goods has attained a high degree of perfection. Within a few years its use in the United States has increased remarkably, in a large measure, no doubt, on account of its combination with silver, which is believed to have originated in this country. The striking contrast of the dead black of the wood and the brilliant white of the silver has from the outset commended it to the American public. This combination, it is said, has now been introduced into England and other European countries. The silver mounting of the ebony gives scope for the taste and originality of the silversmith. The style of decoration most frequently used on the larger pieces consists of a border of scrolls, of flowers, or of a combination of scrolls and floral designs. The variety and degree of elaboration of the borders shown are almost endless. Sometimes the border extends only half way around the edge of the article. A silver shield, on which the initials of the owner may be engraved, is generally placed in the center of the piece. This shield is occasionally replaced by a monogram, more or less elaborate, which may be the only mountings used. Large initials are also used instead of a monogram. Another style of decoration consists of a beaded edge of silver. While the border is occasionally used on smaller pieces, the decoration for these is generally confined to a shield or monogram. The shield may be combined with floral designs or scrolls. The name ebony is given to the wood of several varieties of trees. All kinds of ebony are distinguished for their great density and dark color. The wood in all varieties is heavier than water; the heaviest varieties are the darkest. The other grades require a considerable amount of staining to make them black. Ebony is of a uniform color throughout, and will not show any deterioration even from long-continued use. There are three varieties of ebony well known in commerce. The ebony from the Gaboon coast of Africa is the darkest. The Madagascar ebony is the densest. The Macassar ebony furnishes the largest pieces. Almost all ebony is sent in the form of logs to London, and from there shipped to the various countries in which it is used for manufacturing purposes. It is sold by weight. Imitations of ebony can always be distinguished by their lighter weight, and the cheaper imitations can be detected by merely scratching the surface.

### Wyoming Fossil Discoveries.

The party of scientists who have been investigating the Wyoming fossil beds are having remarkable success, and a large number of boxes containing fossil remains have been sent to the State University, and the work of restoration will soon be begun under the direction of Prof. Wilbur C. Knight.

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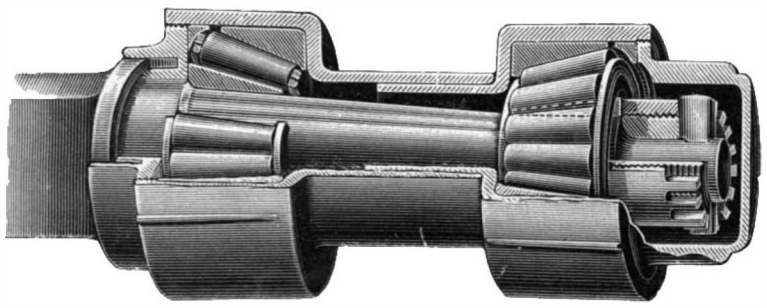
### THE GRANT ROLLER-BEARING.

In the accompanying illustration we present a novel roller-bearing made by the Grant Axle and Wheel Company, of Springfield, Ohio, which has been used with noteworthy success upon wagons, carriages, automobiles, and vehicles in general.

The tapered rollers of the bearing turn between a cone held upon the axle spindle and an exterior coned ring. The inner cones are not keyed to the spindle, but are loose; so that they turn independently of the rollers. Should the rollers bind, the wheels would not be locked; for the cones could still rotate on the spindle. The method of assembling the various parts of the bearing is so apparent from the illustration that no extended description is necessary. Perhaps the most striking feature of the construction is the simple method provided for taking up the wear.

The adjusting nut is held on the outer end of the axle spindle by a pin or cotter passing through the nut and through the reduced end of the axle. The nut is made in two concentric members having threaded connection, whereby the outer portion or shell of the nut may be adjusted inwardly to take up the wear of the cones. Once set, the nut cannot be jarred or loosened from its position. It is evident that the spindle may be removed from the hub or wheel without in any way disturbing the adjustment of the parts.



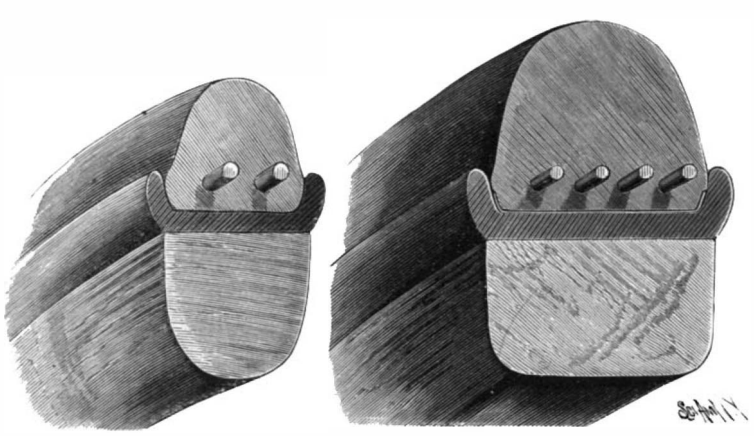
THE GRANT ROLLER-BEARING.

### AN IMPROVED VEHICLE-TIRE.

An ingenious form of tire is being placed upon the market by the Consolidated Rubber Tire Company, of 40 Wall Street, New York city, which is particularly adapted to the requirements of wagon, buggy and carriage wheels.

To the wooden wheel upon which the tire is to be secured a metallic rim is fastened having angularly projecting flanges forming a groove with tapered sides, within which the inner portion of the tire is held. The outer portion of the tire is formed at an angle to the inner portion, the angle or corner between the portions being placed within the outer periphery of the flanges. Openings extend through the entire unexposed portions of the tire, and through these openings independent retaining wires pass, the ends of which are united after the rubber has been endwise compressed. The bottom portion of the tire is reinforced with a canvas strip.

By having the sides of the unexposed portion of the tire inclined and formed at an angle to each other, the compression of the tire in use is such that all portions of the rubber are retained within the groove and no portion is forced over the side of the flange. Thus the cutting of the tire at the corner or angle is prevented, and likewise its breaking inwardly to the openings through which the retaining wires are passed. The reinforcement of the bottom with canvas has a tendency to prevent the breaking of the rubber below that portion of the tire between the retaining wires and the rim. By reason of this construction, it is claimed that the tire is capable of standing more use and of remaining in position longer than most similar contrivances.



AN IMPROVED VEHICLE-TIRE.

PLANS are being made for the construction of a tunnel under the Hooghly River at Calcutta. The river at this point is about 36 feet deep, and according to one of the plans the tunnel will pass 12 feet beneath the bed of the river. The length of the tunnel proper will be 6,875 feet.

### New Coast and Geodetic Survey Vessel.

The new steamer of the United States Coast and Geodetic Survey, the "Pathfinder," after receiving her scientific outfit at Washington, recently started on a voyage to San Francisco via Cape Horn, her destination being Alaska and subsequently the Hawaiian Islands, says The National Geographic Magazine. An examination made by Superintendent Pritchett last year developed the necessity of continuing the geodetic and hydrographic surveys of those islands by the United States government. The land operations, however, have been successfully organized and carried on for the last 25 years by the Hawaiian Government Survey. The steamer carries the necessary instruments for observations of terrestrial magnetism, densities of sea water, current velocities, and sea bottoms, as well as for the regular hydrographic and topographic survey of the coast. A record will also be kept of the phenomena observed while en route along the coast of South America. During the summer seasons the "Pathfinder" will reinforce the ships and parties of the Survey operating in Alaskan waters, retreating during the winter months to the milder Hawaiian shores. The "Pathfinder" is under the command of Frank Walley Perkins, of the Survey staff, with J. C. Dow, a well-known Transatlantic master, as executive officer. She is the largest of the Survey's vessels, and is peculiarly well fitted for the long distance work of the character she undertakes, her coal endurance being about 6,000 miles. She carries a complement of about 75 officers and men. Including the "Pathfinder," the Survey will now have four steam vessels on the Pacific station and three along the Atlantic and Gulf coasts, besides a number of schooners and smaller craft at various points.

### Wireless Telegraphy During the Naval Maneuvers.

We have already referred briefly to the trials of Mr. Marconi's wireless telegraph apparatus at the naval maneuvers, says The Electrician, and we have now received a letter from Mr. Marconi himself giving us some interesting additional information and directing our attention to the significance of the experiments from a theoretical point of view. The maximum distance to which service messages were sent was 60 sea miles, and this was obtained with apparatus similar to that which has been in use for some time past at South Foreland, the vertical wires being 150 feet and 128 feet long. Mr. Marconi points out that it would geometrically be necessary to have poles 700 feet high at each end in order that a line between their summits should clear the curved surface of the earth. The greatest height employed above the level of the sea, however, did not exceed 170 feet, so that the Hertz waves, if it was really Hertz waves that passed, had either to go over a dome of water 530 feet higher than the top of the mast or to pass through it. This thickness of water, Mr. Marconi considers, would probably be much more opaque than Dover cliff. Non-official messages were obtained up to 74 sea miles in one stretch, which Mr. Marconi considers to be an undoubted record for electric waves.

The following detailed particulars of the trials are given in an article by Commander E. P. Statham, R.N., in The Navy and Army Illustrated: When the reserve fleet first assembled at Torbay, the "Juno" was sent out day by day to communicate at various distances with the flagship, and the range was speedily increased to over 30 miles, ultimately reaching something like 50 miles. At Milford Haven the "Europa" was fitted out, the first step being the securing to the main topmast head of a hastily prepared spar, carrying a small gaff or sprit, to which was attached the receiver, the wire from it being brought down to the starboard side of the quarter deck through an insulator and into a roomy deckhouse on the lower afterbridge which contained the various instruments.

When hostilities commenced, the "Europa" was the leading ship of a squadron of seven cruisers dispatched to look for the convoy at the rendezvous. The "Juno" was detached to act as a link when necessary and to scout for the enemy, and the flagship, of course, remained with the slower battle squadron. The "Europa" was in direct communication with the flagship long after leaving Milford Haven, the gap between reaching 30 or 40 miles before she lost touch, steaming ahead at a fast speed.

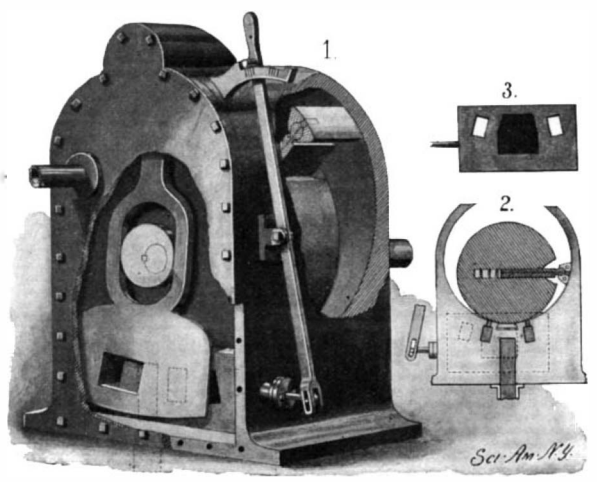
Reaching the convoy at four o'clock one afternoon, and leaving it and the other cruisers in charge of the senior captain, the "Europa" hastened back toward another rendezvous, where the admiral had intended remaining until he should hear whether the enemy had found and captured the convoy. But scarcely had she got well ahead of the slow ships when the "Juno" called her up and announced the admiral coming on to meet the convoy. The "Juno" was at this time fully 60 miles distant from the "Europa."

"Now imagine," says Commander Statham, "a chain of vessels 60 miles apart; only five would be necessary to communicate some vital piece of intelligence from a distance of 300 miles, receive in return their instructions, and act immediately, all in the course of half an hour or less. This is possible already. Doubtless a vast deal more will be done in a year or two or less; and meanwhile the authorities should be making all necessary arrangements for the universal application of wireless telegraphy in the navy. The outfit is not expensive; £120 would probably fit up any ship, and it is sure to become cheaper in time."

### A RECENTLY INVENTED ROTARY ENGINE.

A small, compact rotary engine which is arranged to utilize steam expansively has been patented by Richard Toennes, of Boonville, Mo., and is noteworthy chiefly for the construction of the piston and for the method employed in admitting and controlling the steam. Fig. 1 is a perspective view of the engine with parts broken away to show the cut-off mechanism; Fig. 2 is a partial sectional front elevation; and Fig. 3 is a view of the reversing valve. The piston of the engine is eccentrically mounted and is provided with a spring-pressed piston-head which consists of a shank made in parts breaking joints and which is formed at its outer end with a pivot on which an auxiliary head is mounted to rock, this auxiliary head being likewise made in sections breaking joints. The engine has two main ports, one of which can be used as a supply port and the other as an exhaust port. These ports are reversed in function when the engine is reversed.

To change the direction of the piston motion, a reversing-valve (Fig. 3) is used having two through ports and an exhaust recess or port on one side designed, as the valve is shifted by the long lever shown in the engraving, to connect either main port with the exhaust port. The cut-off mechanism comprises a valve superposed on the reversing-valve and having a swinging arm extending across the engine-shaft. The arm is provided with a yoke which is acted upon by an eccentric on the shaft to cut off the steam and allow it to work expansively. The steam can be cut off at ¼, ½, or ¾ of the piston-stroke. In lubricating the cylinder, piston, and bearings, oil is fed at only three places. With the exception of the shaft, no moving parts are to be seen on the outside of the engine-casing.




PERSPECTIVE AND DETAIL VIEWS OF ROTARY ENGINE.

### Educational Assistance for Young Men.

A very large number of young men are handicapped in business and social life by deficient education. For these there are excellent opportunities presented in the evening classes of the Young Men's Christian Association. Here they may get an education at the same time they are earning a living.

At the West Side Branch, 318 West Fifty-seventh Street, New York, there are elementary and advanced commercial courses, and language and scientific subjects so arranged that a young man can take one or more studies at a time and devote to study as many or as few evenings as he desires.

The courses of study begin on October 2 next. Those participating have the advantage besides of the Reading and Current Topic Clubs, Literary Society, and a library of over 42 000 volumes, which is a decided gain for any young man inclined to better his condition.

A CORRESPONDENT from New Orleans writes us concerning the water hyacinth, about which we recently published an article. He states that the country around New Orleans has also been very much troubled with the water hyacinth, and attempts to mitigate the evil have been made. Experiments have been made on the Melpomene Canal with a chemical spray, and the result has been highly satisfactory.

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### PLANT AND PROCESS FOR FIREPROOFING WOOD.

(Continued from first page.)

work as possible, and what it carries will be rendered non-flammable by some system of fireproofing.

Of the many terrible conflagrations on land, we have quoted that which occurred last spring at the Windsor Hotel, because there is no question that the fearful rapidity with which the building was burned down was due to the large amount of wood which entered into its construction. It might also be mentioned that the destruction of the upper stories of the Home Life building, last winter, would scarcely have occurred, or at least would not have been nearly so complete, if the floors and general trimmings had consisted of non-flammable instead of untreated wood. It seems almost superfluous to emphasize the value of using for constructive purposes in any structure that is at all exposed to fire risk materials that are non-flammable and which in the presence of conflagration will add nothing to the fierceness of the heat.

The accompanying illustrations serve to give a clear conception of the methods adopted by a first-class fireproofing plant in the treating of wood. They represent the plant of the American Wood Fireproofing Company, of Newark, N. J.

As this is one of the latest to be put up, it may be taken as thoroughly representative of the present state of the art.

The plant consists essentially of three large digesters, which are built up of three-quarter inch flanged steel, and guaranteed to a pressure of 400 pounds to the square inch. Two of these are 6 feet 8 inches in internal diameter and 106 feet in length, and the third is of the same diameter and 32 feet in length. One end is permanently closed by a hemispherical head; the other end is provided with a massive cast steel hinged cover, 6 tons in weight, which is hung on a vertical hinge and may be swung to one side, as shown in our engravings, during the charging and emptying of the digester. It is provided with 36 heavy radial bolts, which engage the same number of sockets formed on the face of a cast steel flange on the digester. The locking bolts are of a rectangular cross-section and are cam-shaped at their outer ends, while at the center they abut against the inner side of a large plate washer. This washer is carried upon a massive screwbolt, which projects from the center of the cover, and is driven home against the cover by means of a massive threaded nut and hand-wheel, as shown in the general illustration of the plant. As the nut is screwed home, it presses the plate washer down upon the inner ends of the radial bolts, driving them into their several sockets and causing them to act with a cam-like effect to press the hinged cover to a snug bearing upon the face of the digester. A track formed of lengths of Z-iron runs the full length of the digester. A short piece of movable track is provided, by means of which these rails may be connected with the system of tracks which extends throughout the yard.

The wood which is to be treated is loaded upon small trucks until it conforms approximately to the curve and diameter of the cylinders, care being taken to observe a somewhat uniform spacing in order to allow a free circulation for the chemical solution with which the wood is to be treated. The timber is then secured to the tracks by iron bands and the trucks are wheeled into the cylinders and clamped down securely to the track. The end doors are then packed with a rubber gasket, swung to, and securely clamped. Steam is now admitted at a low pressure of about 10 pounds to the square inch, and the whole charge is submitted to a steam bath, which penetrates the wood, softening and loosening the dried juices which have remained in its fiber. The length of time during which the charge is subjected to the steam bath depends both upon the variety of the wood and its thickness, and it may be anywhere from one to fifty hours. After the steaming process is complete, a powerful vacuum pump is applied for a period of from three to fifteen hours, the vacuum as recorded by the gage being from 27½ to 28 inches. The immediate effect of the vacuum is to draw out of the cellular structure of the wood all of the saps, juices, etc., and leave it in a condition which might be described as that of an extremely finely divided honeycomb. When the vacuum treatment is complete, an alkaline solution is allowed to flow into the cylinders, great care being taken to prevent the entrance of any air. As the solution rises in the cylinders it is absorbed by the cavities of the wood until the latter is nearly saturated. To assist the absorption, the pressure pump is started and the pressure is raised to 200 pounds to the square inch, the pumping being maintained as long as there are any indications that the wood is absorbing the solution. The surplus is then pumped back from the cylinders to the storage tank, the doors are opened, and the wood is run out again to be stacked in the air for drying, or if so desired it is run directly into a drying kiln. In drying, the water evaporates and leaves all the inner walls of the cells covered with minute crystals of fireproofing salts.

This completes the process, and the treated wood is to all appearances the same as before it went through the operation. It contains all of its original properties except that by withdrawing all that remained of the juices the wood has been relieved of that portion of it that would tend to set up fermentation. Hence, incidentally, the treatment is a preservative one, for it substitutes an antiseptic in place of material which is the direct cause of dry rot. The treatment also has the advantage that the wood is so thoroughly filled that when it comes to be painted very much less oil is required than would be necessary in the case of untreated wood. Moreover, the fireproofed material is susceptible of a much higher polish even in the case of such soft woods as white pine and poplar.

Extensive tests of the treated timber have shown that the strength of the wood is slightly increased in some varieties, and slightly decreased in others, the average decrease of strength in all the varieties of timber that have been treated and tested being not over 5 per cent. Such a heavy impregnation with salts necessarily adds to the weight of timber, the increase being from 5 to 15 per cent, according to the variety that is under treatment.

One of our illustrations shows a little experiment which strongly illustrates the non-flammable quality of the wood. Not only is it impossible to ignite a shaving, but a strip of wood may be subjected to the heat of a blowpipe without any appearance of a flame, and nothing more than a temporary glow, which passes off immediately upon the removal of the blowpipe. This experiment proves that although the treated wood may be charred to a certain depth, beyond which the heat fails to penetrate, it is impossible for it to burst into flame and add to the heat of a conflagration.

The process as carried out at these works and above described has been approved by the recent United States Naval Board as being equal to any submitted to that board for test. The company has recently received a contract from the government to supply the interior wood construction for a building which is now being erected at the Brooklyn navy yard for use by the Ordnance Department of the United States navy for the storage of high explosives. The process has also been accepted by the Civil Engineering Bureau for use in the new executive building at the same navy yard, and the General Electric Company have now under treatment lumber to rebuild where fire recently damaged one of their buildings.

### Notes on the Columbus Meeting of the American Association for the Advancement of Science.

An interesting paper was read in the chemical section by Wilder D. Bancroft, of Cornell, on the Relation of Physical Chemistry to Technical Chemistry. It was held that practically every process now used in technical chemistry can be improved in output or in economy. This improvement must come by a study of the reactions, and hence physical chemistry, which is a study of chemical reactions, is of paramount importance to the student who intends to take up chemical work.

Dr. H. W. Wiley and W. H. Krug, of the Agricultural Department, presented a paper on some new products of corn stalks, which was illustrated by a large number of samples. Among the products of greater or less commercial value are cellulose pith and compressed pith, for coffer dams and for lining the armor plate of war vessels, nitrocellulose for explosives, smokeless powder, and collodion—these from the pith—and from the outer part of the stalk, cattle and chicken feed, either alone or saturated with molasses and mixed with other substances, paper pulp, and nitroglycerin absorbents for dynamite.

Dr. Charles Baskerville, of the University of North Carolina, read a paper on the wide distribution of titanium. The experiments of Dunnington have shown it to occur in practically all soils; of Wait, that it occurs in the ashes of most, if not all, plants; of Wait and of Howe, that it is a constant constituent of bones and is probably present in most flesh, and now Dr. Baskerville shows that it must be considered as one of the constant constituents of the human organism.

Prof. H. A. Weber, of the Ohio State University, gave an account of the practical methods of testing soils for the application of fertilizers in use at Columbus.

Five drain tiles are partly filled with sand and placed erect in a box of sand. The upper part of the tile is filled with the soil to be tested. No. 1 is mixed with superphosphate, potassium sulphate, and sodium nitrate, Nos. 2, 3 and 4 with two fertilizers only, while No. 5 contains the soil alone. Fifteen wheat or oat or barley grains are sowed in each plot, and by their relative growth can be told the fertilizers needed by the soil.

Fifty-five papers were presented in Section C, but quite a number of them were read by title. The attendance in the section was very large.

OUT of 2,489 miles of railways in Switzerland, only 56½ miles are rack railways. There are nearly 12 miles of cable lines and 89 miles of street tramways.

## Correspondence.

### Class Experiment Showing How the Resistance of Carbon Falls with Rise of Temperature.

To the Editor of the SCIENTIFIC AMERICAN:

I am in the habit of giving an illustration of the decrease of resistance in carbon with increase of temperature, which commends itself by reason of its effectiveness and simplicity.

In a 110-volt circuit, I introduce a piece of charcoal some four or five inches long. The spark produced upon short-circuiting this stick at one of the contacts ignites the charcoal there. Then I slowly draw the short-circuiting wire from the ignited point zigzag along the surface to the end. The glow follows the wire and is maintained. Thus the current keeps to the path it has "blazed" for itself throughout all the fifteen or sixteen inches of meandering, preferring the road that is hot, though long, to the short but uninviting chilliness of the straight line.

I. J. KAVANAGH, S.J.

St. Mary's College, Montreal.

### Automobile News.

A new automobile journal entitled Die Automobile is to be issued fortnightly in Berlin.

The Automobile Association in Germany, according to The Cycle Age, are continually arranging tests to help to popularize the motor vehicle.

It is said that a test of a gas engine automobile will be made by carrying a message from Brig.-Gen. Anderson, at Chicago, to Maj.-Gen. Merritt, at New York.

The police department of Hartford, Conn., will soon be equipped with automobile patrol wagons, ambulance, and prisoners' van. There are great possibilities in the way of the use of automobiles for municipal work.

An electric brougham in Boston was recently upset through the collapse of the front wheel tire, and its two occupants were badly scared, although they were not injured. The front tires of broughams and the rear tires of electric hansoms are those most liable to punctures and other injuries.

It is reported that the New York Central Railway intends to establish an electric cab service in New York and other large cities along the line, and the Pennsylvania Railroad has been experimenting with a sample vehicle, and it is possible that these carriages may be substituted for the horse-driven cabs at the stations of the company's system.

An automobile ambulance is being made for St. Vincent's Hospital, New York city. It will be propelled by electricity, and will be a model of its kind. Electric power is more advantageous for propelling a vehicle where it is essential to have a very steady motion. The large pneumatic tires, it is expected, will also contribute in no small degree to the comfort of the patient.

It is probable that the maximum speed allowed to automobiles in Paris will be greatly decreased, and also that persons must possess certificates as to their knowledge of and ability to run automobiles. In a single week The Electrical World says that eight persons were killed and as many as fifty injured through automobile accidents in and near Paris. In nearly every case these accidents were owing to rapid traveling or to the ignorance of the drivers.

### A Bridge Destroyed by Electricity.

The bridge over the Wabash River at Clinton, Indiana, was recently destroyed with the aid of electricity. It was a wooden bridge resting on stone piers and it was very essential to have the bridge removed by a certain time. Of course, dynamite could have been used, but the explosion would have injured or destroyed the piers, and if the bridge was set on fire it would have cracked or injured the masonry. An electrician agreed to wreck the wooden structure without injuring the piers. Each span of the bridge was composed of nine chords, each consisting of three timbers. If the twenty-seven sills were cut simultaneously, the spans would drop into the river at the same instant. This was actually done, the cutting being accomplished by burning through the wood by loops of iron wire made hot by the passage of the electric current. No. 12 wire was used for the loops, and at the bottom of each loop a five-pound sash weight was fastened to an insulator. This weight pulled the loop down as it burnt its way through the timber. According to The Western Electrician, an alternating current of fifty volts pressure was employed. One span was wrecked at a time, and the total time which elapsed from the turning of the current until the fall of the span was one hour and forty minutes in each case. After the fall of the bridge an examination showed that all of the sills were burned by the wire loop in exactly the same manner, five inches deep on the top and three inches deep on the sides. When this depth was reached the weight of the span fractured the remaining wood. The cut was sharp and clean and the wood was not charred more than an inch from the place of the fracture. Two thousand spectators witnessed the feat.

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### Science Notes.

A novelty is the cold storage of hops. This is done in several places in England. Several systems are employed, notably the Linde, Pontifex and De la Vergne.

The second annual report of the Council of the Roentgen Society shows that steady progress is being made, and the Society now numbers, according to Nature, 148 ordinary members and five honorary members.

The Japanese government has decided to make vaccination compulsory in Japan, and that all children are to be vaccinated before they reach the age of ten months. They must be revaccinated when they are six and again when they are twelve years of age.

It is said that Dr. Nansen will not undertake another northern polar expedition, but that he is much interested in Antarctic explorations, and it is possible that his next trip will be toward the south. He is now engaged on his large scientific work on polar explorations.

The German toy trade has fallen off greatly, and the government has established a professional school of toy making at Grünhainiden. This is an excellent example of the careful attention which Germany is giving to other phases of the manufacturing industry and export trade.

In the working of fluorine the great objection has been that the apparatus that comes in contact with the flourine must be either of platinum or fluorspar. M. Moissan is now, however, using vessels of copper, which is less attacked than other metals. This is probably caused by the thin layer of copper fluoride which forms on the copper and which is insoluble in hydrofluoric acid.

Germany has prohibited the use of saccharine for the production of beer, wine, etc. Other artificial sweetening substances are also interdicted. Belgium has prohibited the importation, manufacture or sale of saccharine except for medical purposes, and France also prohibits the use of these substances in food. In Great Britain saccharine must not be used in beer manufacture. In Spain, Portugal and Austro-Hungary similar laws are in force.

According to The Nation, a Danish northern light expedition has just left Copenhagen for Iceland. The expedition has been several months under preparation, and its members have been carefully practiced in the use of the instruments. Two stations will be built, and will be connected by telephone and by an optical telegraph. The Director of the Danish Meteorological Office, Dr. Adam Paulsen, is at the head of the expedition, and he will test his own published theories on the aurora, as well as all of the other late ones of the various scientists. The expedition will return in May, 1900.

A year ago Cornell University secured 30,000 acres of woodland in the Adirondack Mountains for the exclusive use of her forestry department. The land has been divided into a number of sections and several seed beds have been laid out in which there has been planted over a million small trees of different varieties. The students of forestry will study the theory of the subject from October to April, and from then until Commencement they will study the practical side of forestry. Cornell University is the only college in the United States which has a forestry department. Prof. John Gifford was recently elected to the Chair of Forestry in the University.

Dr. E. W. Allen, Assistant Director of Experimental Stations in the Agricultural Department, has just returned from the West, after inspecting various stations. One of the most interesting matters to which he devoted his attention was the collection of facts relating to cheese making. The station at Wisconsin is taking the lead in this matter, and the discoveries which have been made there are at variance with those made in Europe—that the ripening of cheese is due to bacteria. American experiments demonstrate beyond doubt that the principal change in the albuminoids which takes place in the ripening process is dependent upon the fermentation in the milk itself and not upon the bacteria.

Siberia is no longer a penal colony. The present Emperor, Nicholas II., has issued an order for a commission to work out schemes to replace the transportation of criminals by punishments by the courts; to reorganize penal servitude and the deportation which follows, and to better the condition of convicts now in Siberia. It will also devise means for establishing compulsory public labor and workhouses as penal measures. The transportation of criminals to Siberia was established in the seventeenth century, and it assisted in populating this vast and wealthy region, which was in need of workmen for constructing roads, fortresses, and in cultivating government lands; but in the development of easy means of communication and the beginning of the industries, Siberia has lost something of its penal character, and now, under the new edicts of the Emperor, almost as satisfactory results may be looked for as in the case of Australia, which was once practically nothing but a dumping ground for criminals.

### Engineering Notes.

The Russian ice-breaking steamer "Ermak" has just finished a two weeks' trip to the northwest of Spitzbergen. She passed through about 200 miles of ice, and its thickness is estimated at about 14 feet. The ship performed the task without injury.

The Baltimore and Ohio has changed the names of its dining cars from those of Roman generals to the names of the popular hotels in the great cities touched by their line. Thus, we have the "Waldorf," "Savoy," etc., for New York, "Carrollton" for Baltimore, the "Raleigh" for Washington, etc.

A cyanide leaching vat made of wood which had been in use for four years was recently tested as to the percentage of values absorbed. A hole was bored one half inch deep in the bottom, and the shavings therefrom assayed $13 per ton. Thus, says The Mining and Scientific Press, the absorption by wooden tanks is shown not to be as great as has been claimed.

The Central Railroad of New Jersey has instituted examinations for its baggagemen. All of the men employed in the baggage department will be compelled to undergo an examination, in order to retain their positions. The examination will be in the nature of questions concerning the route of a piece of baggage from one station to another and methods of tracing lost pieces of baggage, etc.

There is now under construction at a Baltimore shipyard a large floating dry dock for the United States navy, which is to be stationed at Algiers, La.; the plans for which were prepared by Messrs. Clark & Standfield, London. This dock will not be launched in the regular manner, but is being constructed in a basin dredged for the purpose, into which the water will be admitted when she is ready to be floated.

The American coal exhibit at the Paris Exposition will be very complete. It will consist largely of small cubes of about four pounds weight. Views of various collieries, shipping arrangements, etc., will also be shown. A model of the New York State prison at Sing Sing will be one of the exhibits of the State of New York. The model itself will be made of alabaster and is the work of the inmates.

Mr. Henry Hess, in a recent issue of The American Machinist, gives some information regarding force fits which he obtained from a prominent engine-building concern in Ohio, and from which he has deduced the following approximate formulæ: For crank fits $P = 9{\cdot}9D - 14$ up to $D = 10$ in. For crank fits $P = 5D + 40$ from $D = 12$ in. to 24 in. Straight crank pins $P = 13D$. Taper crank pins $P = 14D - 7$. Where P = total pressure on ram in tons to force on and D = diameter in inches. For cranks and straight pins allow 0·0025 in. per inch of diameter. Taper crank pins are fitted on the lathe to within ⅛ inch of shoulder and then forced home. Taper $\frac{1}{16}$ per inch.

The last train to leave the old Park Square station, Boston, was the New York express, which left at 12:03 A. M. on September 10. It went out of the station with the burning of red fire and the cracking of railroad torpedoes. Then the work of demolishing began, some of the interior fittings being taken out for use at the new Back Bay station, which is not entirely completed. This removal completes the scheme of passenger train consolidation of all the roads entering the city from the south. The Park Square station was finished in 1875 and cost about $800,000. It is not known as yet what will be done with the property, but it is possible that it will be turned into a market.

The embargo on Lake Superior navigation caused by the sinking of a steamer in the Soo Passage was raised on September 10, and more than 200 large craft began to move. One vast procession headed down the lakes, while another started on its way to Lake Superior. The vessel was sunk by collision with a schooner. Divers succeeded in putting a patch of wood over the break in the "Houghton," and the ore with which the boat was loaded was shoveled into lighters. The rocks which held the vessel were blasted, and the vessel was pulled out into the channel. The downbound fleet was carrying 300,000 tons of iron ore, 11,900,000 feet of lumber and 900,000 bushels of wheat.

The committee appointed by the American Society of Mechanical Engineers to revise its code for conducting boiler tests has decided that heating surfaces must be measured on the fire side. This means that the inside surface of the tube must be taken when used in a horizontal tubular boiler and the outside when used in a water-tube boiler. This, says Power, gives the water-tube boiler about 7½ or 8 per cent more heating surface per foot of tube with 4 inch and 3 inch tubes respectively, and necessitates the use of tables or a knowledge of the thickness of tubes when computing the surface of fire-tube boilers. The boiler horse power is made 34½ units of evaporation per hour, i. e., 34½ pounds of water evaporated from and at 212°; this is equivalent to the transfer of 33,317 British thermal units per hour. The old unit, the evaporation of 30 pounds per hour from 100° Fah. into steam of 70 pounds, was equivalent to the transfer of 33,305.

### Electrical Notes.

Pekin is now to have an electric railroad running from the south gate of the city to the steam railroad station, and it is even hoped that permission to enter the city may soon be obtained. The road is built by a German firm.

An electric road for the Catskill Mountains is now being surveyed. It will connect with the Otis Elevating Railway, and from there will run from Saugerties to Catskill, connecting there with the railway. The right of way has been secured, and construction will soon be begun.

Street sweeping by electricity has been introduced in St. Louis. The appliance is said to be of ordinary construction, save that the broom wheel in the rear is operated by electricity, which is found to be more effective than if the brushes derived their rotation from the road wheels.

It is reported that the wireless telegraph apparatus of a young Swedish engineer named Orling will be tested by Lord Armstrong. He will get some of the Atlantic liners to use the transmitters and receivers while crossing the ocean, and thus try to communicate with them at a land station.

A new Swiss railway from Thun to Burgdorf was opened recently, says The Engineer. The line is electrically driven by three-phase current at 750 volts. Its length is 25 miles, and the power is derived from the river Kander. The current is generated at Spiez at a pressure of 4,000 volts, and then transformed up to 16,000 volts, at which pressure it is transmitted by overhead wires to 14 transformers along the line.

The experiments in wireless telegraphy which have been carried on at Dover have been most successful. Messages have been sent from the Town Hall at Dover to the South Foreland, the waves passing through the Castle Rock, which is 400 feet higher than the Town Hall flagstaff. The results were most satisfactory. It is hoped that messages can be transmitted between the British and French associations at their meetings.

Vice-Consul-General Hanauer writes from Frankfort, July 22, 1899, that the total length of the street-railway system in Frankfort at the end of the year 1897 was 30½ kilometers (18·9 miles). The gross receipts during that year were 2,655,685 marks ($632,000), of which 288,722 marks (68,000) were paid to the city treasury, according to the contract. There were 781 horses and 197 cars in use, and 26,507,403 passengers were carried during the year. The net proceeds amounted to 430,491 marks ($102,457).

The Glasgow Town Council has confirmed the recommendations of the tramways committee giving the contract for two electric traction engines to the Allis Company. It is said that the decision of the council has occasioned much disappointment to home firms, but they could not compete with the speedy delivery of the Milwaukee firm. There are two or three new schemes for electric subways in London, and it is probable some of the projects will materialize in the autumn, and this will afford an opportunity for further supplies of American equipment.

According to The Electrical World, a patent was granted August 1 to Gustav Platner, of Witzenhausen, Germany, for a new primary battery depolarization solution composed of chlorates combined with metallic salts capable of readily forming basic salts and disengaging acids or halogens. Among the chemical compounds named are salts of iron, such as chloride sulphate of iron and iron and chromium salts. For example, in the case of a carbon cylinder battery, the cylinder containing a dry mixture of sulphate of iron, chlorate of potash or sodium and peroxide of manganese tightly packed together, with zinc in a solution of chloride of ammonium, an E. M. F. of 1·8 to 1·9 volts is obtained. The chemical action gives rise to a basic iron or chromium salt, while the sulphuric acid decomposes the chloric acid, which at once separates into chlorine and oxygen. This action, however, takes place so slowly that the cell would remain constant for a very long period.

The general results of the magnetic survey of Sicily and the adjoining islands, commenced in 1890 by Prof. Chistoni and Signor L. Palazzo, were recapitulated in a communication by the latter observer to the Atti dei Lincei, vi., (2) 11. In Terrestrial Magnetism for June, 1899, Signor Palazzo now gives a magnetic chart of Sicily, showing the course of the isogonal and isoclinal lines, and the isodynamical lines for the horizontal component. The remarkable deviations produced in these curves by volcanic areas are well shown. Signor Palazzo, having been appointed as a delegate at the International Magnetic Conference held in connection with the Bristol meeting of the British Association last year, availed himself of the opportunity for instituting a comparison between the magnetic instruments of the Italian Central Meteorological Office and those of Parc Saint-Maur and Kew. The results of this comparison have been published in the Atti dei Lincei, viii., (1) 8 and 9, and the author considers that these comparisons fully establish the trustworthiness of the Italian instruments and methods.—Nature.

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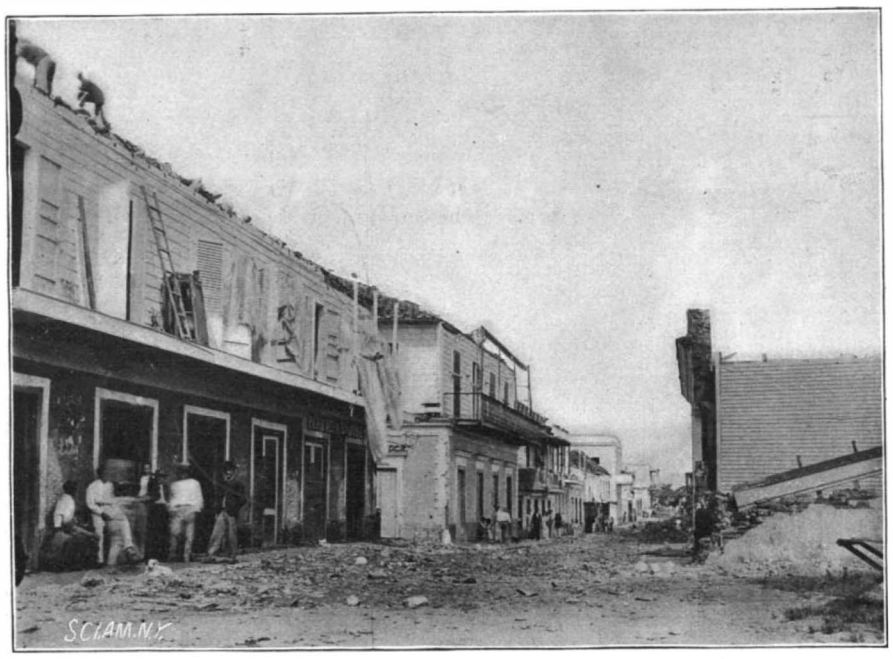
## IN THE PATH OF THE PORTO RICAN HURRICANE.

The accompanying views showing the destruction wrought by the recent hurricane in Porto Rico speak for themselves, and give a more graphic picture of the terrific force of wind and flood than can be conveyed by descriptive writing. Three of the photographs were taken in the town of Caguas, a place of 14,000 inhabitants which is situated in one of the richest tobacco districts of the island and is like Cayey and Camerio one of the most productive centers of the tobacco industry. The other view is taken on the celebrated military road which runs from San Juan through the island to the city of Ponce. This bridge is a modern steel structure which was built to carry the road across the river Piedras. It is situated about 21 miles from San Juan, and in the solidity of its construction it was a fair sample of the excellent work which is characteristic of the whole of the military road above mentioned. The river San Piedras is in ordinary seasons an inconsiderable stream, but within four hours after the storm had burst in this locality it had swelled into a raging torrent. As viewed in the illustration it flows in the direction of the bridge as seen from the point of view at which the photograph was made. The rush of water appears to have washed away the embankment which formed the approach to the bridge on the left, and getting in behind the abutment it brought down the masonry with one end of the bridge, as shown in the illustration, letting the whole superstructure fall into the river.

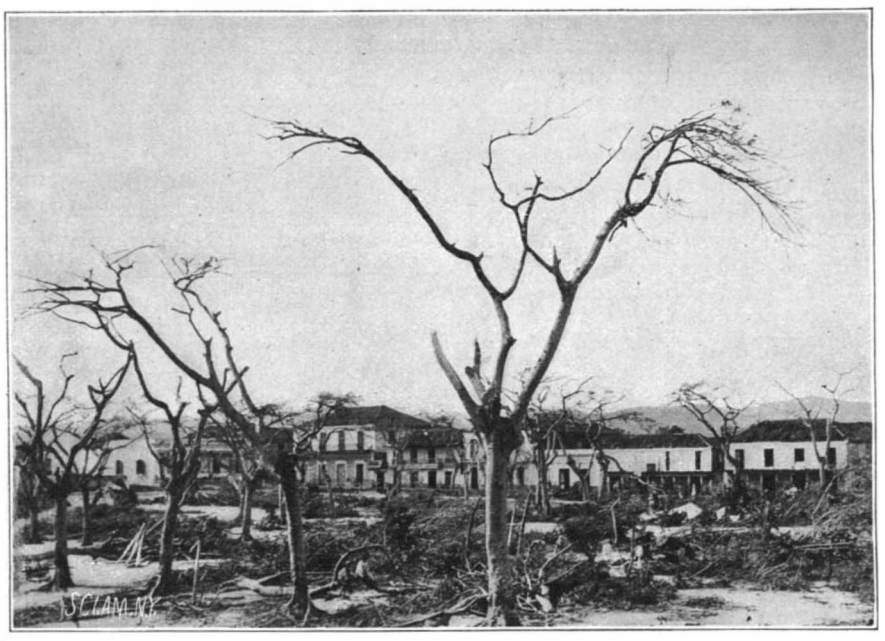
The street which is shown in another photograph is Furabo Street, one of the principal thoroughfares of Caguas. It coincides with and forms part of the military road, and along it are to be found the principal stores and places of business. Generally speaking, the lower stories were built of brick and the upper stories were of wooden frame construction. The damage here shown was wrought entirely by the wind and consisted chiefly of the unroofing of houses and, in some cases, the complete demolition of the upper stories.

One of the greatest scenes of desolation after the storm was presented in the public square of Caguas, which was formerly one of the attractive sights of the town and the common place of recreation for the people. It contained a handsome grove of Framboyan trees, and how complete was the havoc wrought by the wind will best be understood from an inspection of the accompanying photograph. Not merely was the foliage entirely stripped from the trees, but the greater part of the branches were torn off and scattered in a confused mass throughout the plaza.

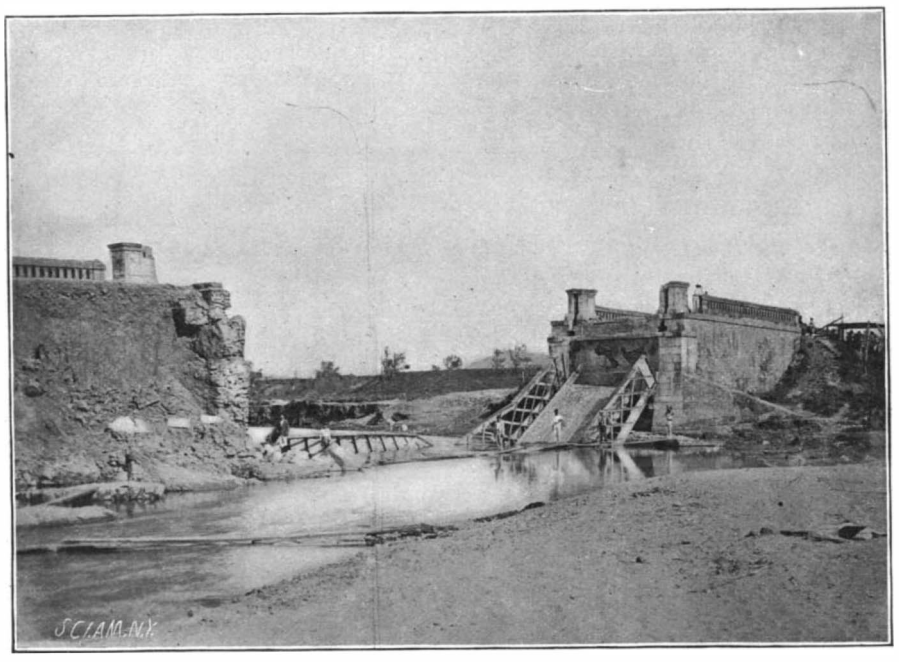
The American people have heard a great deal lately about the flimsy huts which serve as dwelling places for the poorer inhabitants of Cuba and Porto Rico, and the accompanying view taken in the poorer quarters in the suburbs of Caguas proves how extremely



DAMAGE IN THE MAIN STREET OF CAGUAS.

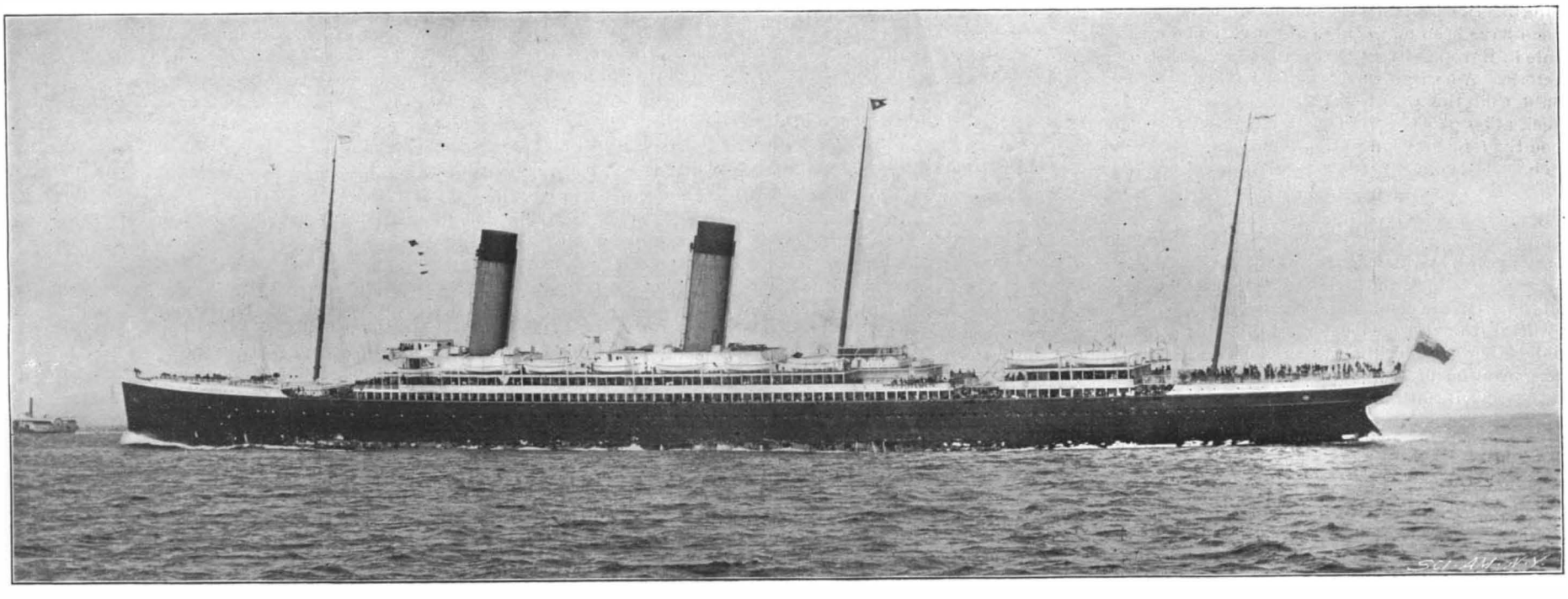


DESOLATION IN PUBLIC SQUARE, CAGUAS.



WRECK OF STEEL BRIDGE ON THE MILITARY ROAD.

STREET OF NATIVE HUTS, SUBURBS OF CAGUAS.



"OCEANIC" PASSING SANDY HOOK ON HER MAIDEN TRANSATLANTIC TRIP.

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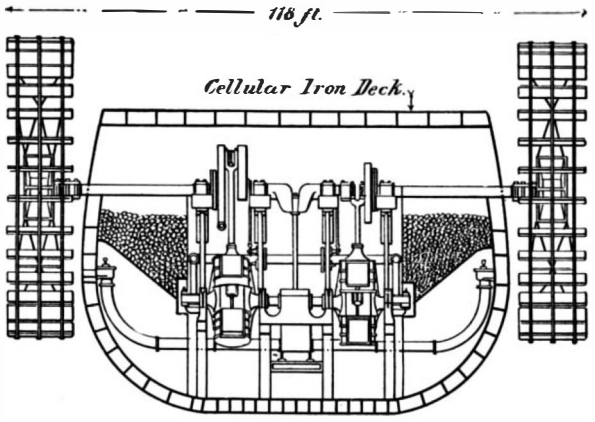
primitive these dwellings really are. The walls consist of rather slight posts set in the ground, closed in with the bark of the native trees, while the roof consist of light pole rafters with a thick covering of palm leaves. The inhabitants of these huts are employed chiefly on the farms and in the tobacco factories, where they do the common laboring, receiving for their services a wage which varies from 38 to 60 cents a day. These poorer classes live on dried codfish, sweet potatoes, rice, beans, bananas and coffee. It can easily be understood that the ravages of the hurricane were not so severely felt by these people as by the owners of the better class of houses; for the matter of repairing one of these huts is merely a question of a day or two.

## THE "GREAT EASTERN" AND THE "OCEANIC"—A COMPARISON.

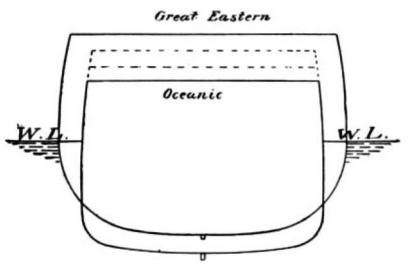
With the arrival of the magnificent liner "Oceanic" of the White Star Line Company at this port after a successful maiden trip, the people of New York city are carried back to the time when, some forty years ago, that other mammoth steamship, the "Great Eastern," made her first trip across the Atlantic. Although the "Oceanic" is a first-class passenger steamship in every particular of the hull, engines, safety and accommodation, and represents in all these respects the highest development of the steamship builders' art, there is no question that it is in respect of her unprecedented size that she will command most attention. For this reason we have thought best to make this article a comparison of the "Oceanic" with the "Great Eastern," with a view to bringing out, incidentally, the great strides which have been made during the past forty years in the building of transatlantic liners.

To begin with the question of size, the "Oceanic" is longer over all by 12 feet and her displacement at a working draught of 32½ feet is greater by 1,500 tons. In beam and depth, however, the ship of the fifties was enormously larger, having a beam of 83 feet as against 68 feet for the "Oceanic," while her depth was 57½ feet as against 49 feet. These differences are shown very clearly in the sectional view of the two ships. At first sight it would naturally puzzle the reader to understand how the "Oceanic" with a cross section so much smaller could have a larger displacement than the "Great Eastern," when both ships are of approximately the same length; but it must be remembered that while the average draught of the "Great Eastern" was only 25½ feet, that of the "Oceanic" is 32½ feet. The fact that a larger proportion of the hull is above the water-line will also explain the more bulky appearance of the "Great Eastern" in our broadside view of the two vessels. Moreover, the model of the "Great Eastern" was considerably finer than that of the "Oceanic"; she did not maintain her




CROSS SECTION OF "GREAT EASTERN" AT THE PADDLE ENGINES.

full beam for any considerable distance amidships, her under-water body fining away toward the ends like that of a yacht. Further, her bilges were very much easier, being rounded up with a broad easy sweep, while those of the "Oceanic," as is the fashion in modern steamships of this class, are nearly square with a flat floor, a small dead rise, and a short radius at the turn.

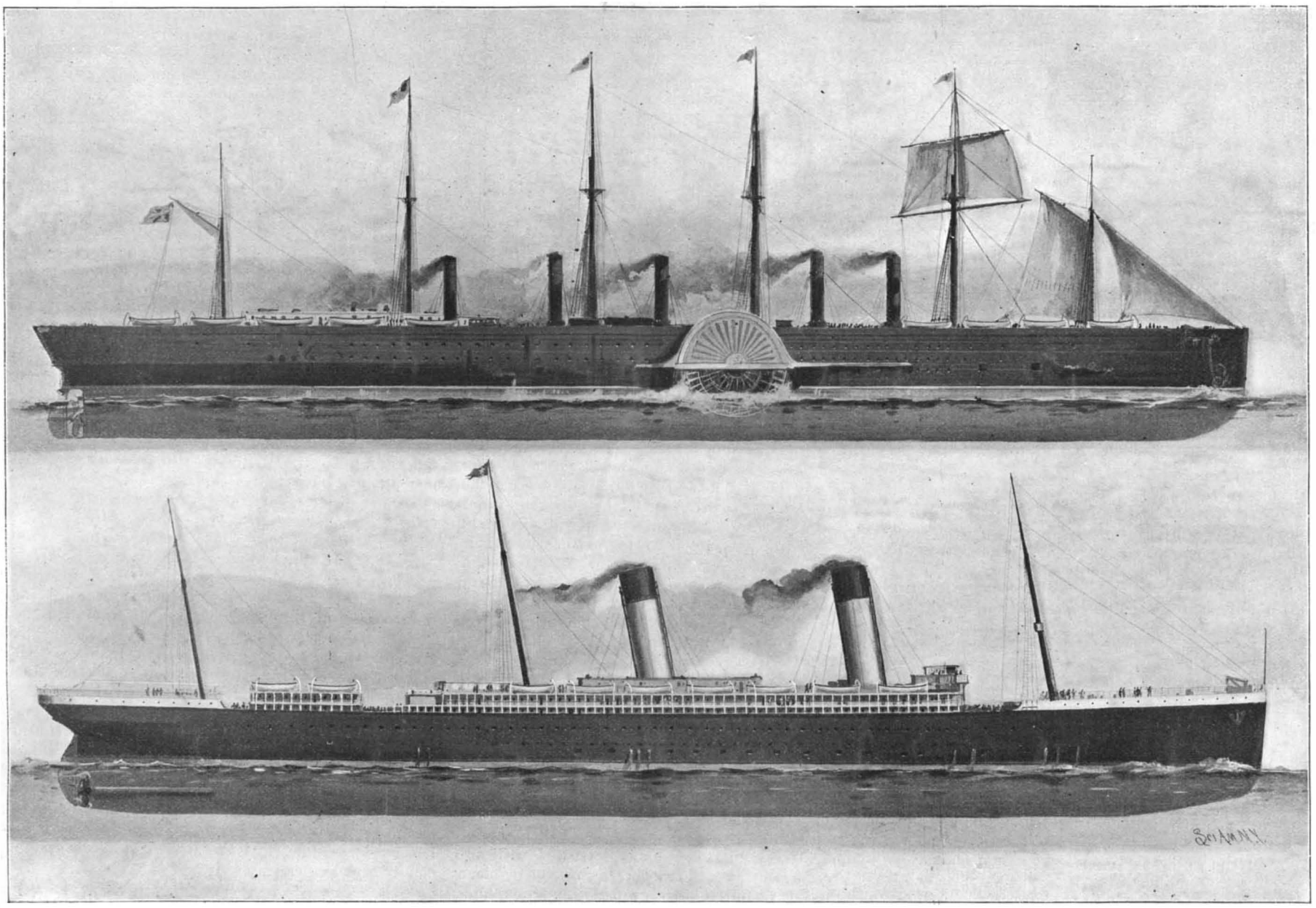



MIDSHIP SECTIONS OF "GREAT EASTERN" AND "OCEANIC."

Another feature which serves to make the "Great Eastern" look more bulky than the modern vessel is the fact that her plating was carried up to the top deck, which was entirely flush from stem to stern and carried only a few deck houses. In the "Oceanic," on the other hand, the two upper decks amidships are carried upon stanchions and extensions of the side frames and have no side plating.

THE "GREAT EASTERN."—The construction of the "Great Eastern" was commenced in the spring of 1854 on the banks of the Thames. She was built broadside on to the water, and the enormous difficulties attending her launch delayed her taking the water until the last day of January, 1858. Her total cost was probably about $4,400,000. She was propelled by two sets of engines. Amidships was a four-cylinder paddle wheel engine of huge dimensions, while astern of this was a horizontal four-cylinder single screw engine. The paddle wheels were enormous affairs, 56 feet in diameter, and each of them weighed over 90 tons, while the breadth of the ship over the paddle wheel boxes was 118 feet. Each of the paddle wheel engine cylinders was 6 feet in diameter by 14 feet stroke, and the indicated horse power was 3,500. The four cylinders of the single screw engine were 7 feet in diameter with a 4-foot stroke, the indicated horse power being 4,500. Steam was supplied by ten double-ended multi-tubular box boilers, which carried a working pressure of 20 pounds to the square inch. The total daily consumption of coal when the vessel was running at full speed was 400 tons. The bunkers had the enormous capacity of 12,000 tons, this large supply being provided with a view to enabling the vessel to steam out to Australia and back without recoaling. The hull was constructed of iron, and, considering the early date at which it was built, it was a masterpiece of construction, and was of a strength which has probably never been exceeded in modern vessels. In the first place, the double bottom was carried, as shown in our cut, well above the water-line, and the upper deck, like the bottom, was of cellular construction, and consisted of a series of longitudinal girders extending throughout the entire length of the ship and closed in at top and bottom by plating. Fully 30,000 plates were used in the vessel, and when she was launched her estimated weight was about 8,500 tons. Provision for safety was made by building the ship with twelve watertight compartments below the lower deck and nine compartments above it. The ship carried four decks in all, and her passenger accommodation, in respect of the total number carried, was far ahead of anything that has ever since been attempted, provision being made for 800 saloon passengers, 2,000 intermediate, and 1,200 steerage passengers. The staterooms and saloons were built on what were for those days very generous proportions. The main saloon measured 36 feet in width by 100 feet in length and 13 feet from floor to ceiling.

On her first trip to this country she made the passage in eleven days two hours. Her maximum speed was 14½ knots, and her average speed during the time



"Great Eastern"—Length over all, 692 feet; beam, 83 feet; depth, 57½ feet; displacement on 25½ feet draught, 27,000 tons; horse power, 8,000; maximum speed, 14½ knots.
"Oceanic"— " 704 " " 68 " " 49 " " " 32½ " " 28,500 " " 28,000; " " 21¼ knots.

"GREAT EASTERN" AND "OCEANIC" COMPARED.

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she was under full steam was about 13 knots. Although, financially, she was a failure, her vast size proved most opportune for the task of laying the transatlantic cable. The latter days of the great ship were somewhat ignominious. After being sold to an enterprising speculator, who used her for show purposes, she was sold for old iron and broken up on the banks of the Mersey. If we bear in mind that the art of iron shipbuilding was in its infancy at the time she was built, we must admit that the construction of the "Great Eastern" was, and is to-day, the greatest engineering feat of the nineteenth century, and reflects the highest credit upon her designers, J. Scott Russell and I. K. Brunel.

THE "OCEANIC"—We have recently described the "Oceanic" at such great length that it will not be necessary at this time to do more than recapitulate her leading features. In her lines and general arrangement the new ship is an enlargement of the White Star boats "Majestic" and "Teutonic," and unless one is near enough to realize her gigantic proportions, she might easily be mistaken for either of these vessels.

DIMENSIONS OF THE LARGEST OCEAN STEAMERS.

| Name of Ship. | Date. | Length Over All. | Beam. | Depth. | Draught. | Displacement. | Speed. |
|---|---|---|---|---|---|---|---|
| | | Feet | Feet | Feet | Feet | Tons | Knots |
| Great Eastern..... | 1858 | 692 | 83 | 57½ | 25½ | 27,000 | 14½ |
| Paris ..... | 1888 | 560 | 63 | 42 | 26½ | 15,000 | 20 |
| Teutonic... | 1890 | 585 | 57½ | 42 | 26 | 13,800 | 20 |
| St. Paul.... | 1895 | 554 | 63 | 42 | 27 | 16,000 | 21 |
| Campania.. | 1893 | 625 | 65 | 41½ | 28 | 19,000 | 22 |
| Kaiser Wilhelm der Grosse . | 1897 | 649 | 66 | 43 | 29 | 20,000 | 22·62 |
| Oceanic..... | 1899 | 704 | 68 | 49 | 32½ | 28,500 | 21¼ |

The accompanying table shows what an advance in size has been made in the "Oceanic" over existing ships. She is 42 per cent larger than the next largest transatlantic liner, "Kaiser Wilhelm der Grosse," whose displacement on a draught of 29 feet is 20,000 tons. Following the "Kaiser Wilhelm" is the "Campania," of 19,000 tons, and then in order of size come the "St. Paul," of 16,000 tons, the "Paris," of 15,000 tons, and the "Teutonic," of 13,800 tons. But though the vessel is so much larger, she does not compare in speed with the fastest of the transatlantic liners. Her indicated horse power is only 28,000, or the same as that of the "Kaiser Wilhelm der Grosse," and the estimated sea speed is only 20 knots an hour, as against a sea speed of over 22½ knots, which has been achieved by the North German Lloyd vessel. It is the belief of the White Star Company that the average transatlantic traveler cares less about extremely high speed than is generally supposed, and it is believed that by giving the "Oceanic" sufficient power to enable her to make the trip with great regularity, the company will not only effect a great saving of fuel, but will meet all the wishes of the traveling public. Thus, it is claimed that the saving of twelve hours by pushing a vessel across the Atlantic at the highest speed frequently serves merely to bring the ship into New York Harbor just too late to pass Quarantine. This necessitates the passengers being detained on board until the following morning.

In the construction of the vessel great attention has been paid to the elements of strength and stiffness. The frames are heavy channel irons of steel 9 inches in depth, spaced 31½ inches from center to center. The plating varies in thickness from 1 inch to 1½ inches. The double bottom extends throughout the full length of the ship, and in general is a little over 5 feet in depth, except beneath the engines, where, in order to comply with naval requirements, the depth is increased to 7 feet. Great strength is also derived from the five steel decks, which are completely plated from stem to stern. Including the inside floor of the ship's bottom, there are seven distinct decks, and above these a boat deck which extends for several hundred feet amidships. The captain's bridge is about 96 feet above the keel, and will be 68 feet above the water when the ship is down to her present load line of 29 feet.

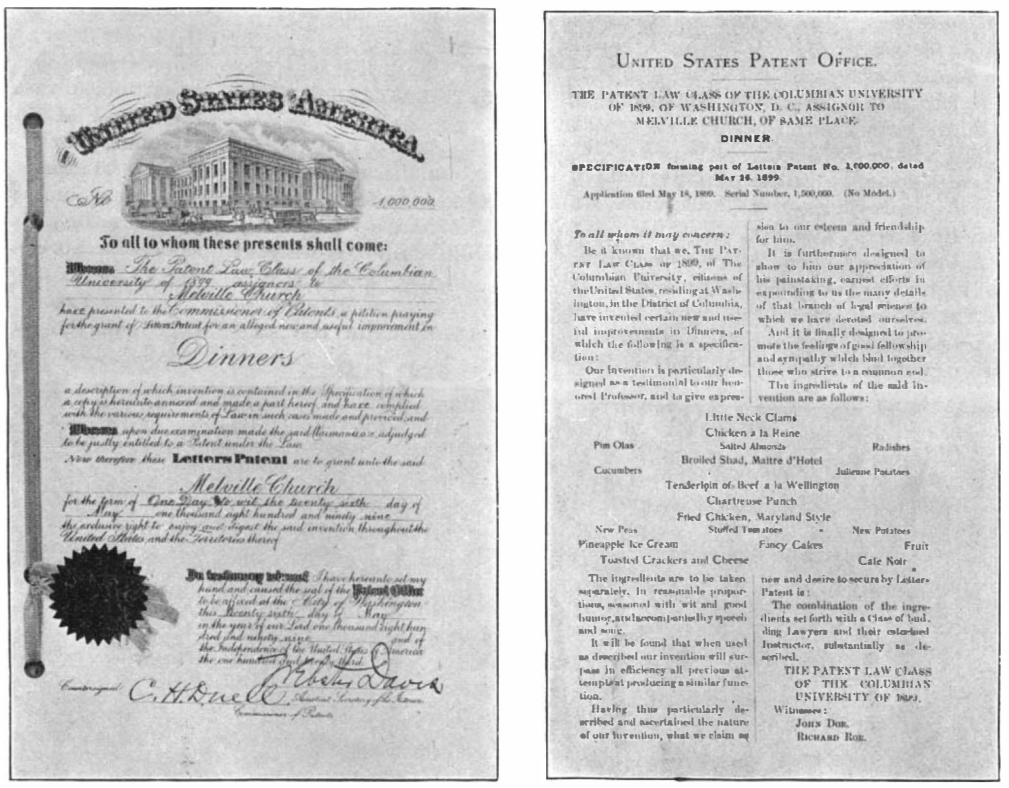
The engines are of the twin-screw triple-compound inverted type, working upon four cranks, are set according to the Schlick system, which is designed to reduce vibration and has shown excellent results in practice. The cylinders are high pressure 47½ inches, intermediate 79 inches, and two low pressure 93 inches in diameter, the common stroke being 72 inches.

There are accommodations for 410 first-class passengers, 300 second-class, and 1,000 third-class passengers, and as the crew numbers 390, the total number of people on board when the ship carries her full complement will be 2,100. The decorations are carried out with the good taste which is a marked feature in all the vessels of this line, and while it is rich there is nothing gaudy or over-elaborate. The saloon has the generous proportions of 64 feet in width by 84 feet in length. It has a seating accommodation of 350. The opening in the ceiling under the glass dome is 21 feet square, and the four sides between the pendentives contain allegorical figures that represent respectively Great Britain, America, New York, and Liverpool. The library is an exceedingly picturesque room, measuring 53 feet in length by 40 feet wide, with a height of 9 feet 6 inches from floor to ceiling. An excellent effect has been secured in this room in breaking away from the long, straight sides and forming nooks and recesses. We cannot attempt to enter any further into a detailed description of the passenger accommodation on this fine vessel. It is sufficient to say that her vast size and weight insure a degree of spacious comfort and steadiness of movement which have never before been realized in ocean travel. The total cost of the vessel was five million dollars.

In conclusion we must confess that, contrary to our expectations, the "Oceanic," on a near inspection, looks every inch of her great size. There is a sense of roominess and steadiness both above and below decks far in excess of anything experienced on other large ships, and her behavior in a seaway on the passage over was up to and beyond expectations.

## A NOVEL MENU CARD.

One of the most curious menu cards on record was used by the Patent Law Class of 1899 of Columbian University, Washington, D. C. By the courtesy of one of those who were fortunate enough to partake of the repast, we are enabled to present our readers with a reproduction of this interesting menu card, which simulates a United States patent issued for one day. We are pleased to note that the "ingredients are to be taken separately, in reasonable proportions," and that they are to be "seasoned with wit and good humor and accompanied by speech and song." Of course dinners are very much alike and we do not doubt that the statement of the "invention" that "it will be found that when used as described, our invention will surpass in efficiency all previous attempts to produce a similar function" will at once be challenged. This question will never be decided without recourse to the Court of Appeals of bon vivants.


UNITED STATES PATENT OFFICE.
THE PATENT LAW CLASS OF THE COLUMBIAN UNIVERSITY OF 1899, OF WASHINGTON, D. C., ASSIGNOR TO MELVILLE CHURCH, OF SAME PLACE.
DINNER.
SPECIFICATION forming part of Letters Patent No. 1,000,000, dated May 26, 1899.
Application filed May 18, 1899. Serial Number, 1,500,000. (No Model.)
To all whom it may concern:
Little Neck Clams
Chicken a la Reine
Pim Olas
Salted Almonds
Radishes
Broiled Shad, Maitre d'Hotel
Cucumbers
Julienne Potatoes
Tenderloin of Beef a la Wellington
Chartreuse Punch
Fried Chicken, Maryland Style
New Peas
Stuffed Tomatoes
New Potatoes
Pineapple Ice Cream
Fancy Cakes
Fruit
Toasted Crackers and Cheese
Cafe Noir
THE PATENT LAW CLASS OF THE COLUMBIAN UNIVERSITY OF 1899.
Witnesses:
JOHN DOE.
RICHARD ROE.

MENU CARD SIMULATING A PATENT.

## The Reduction of Prints as Contrasted with the Reduction of Negatives.

The August issue of the Photographische Rundschau contains a long article by Herr Janko on the reduction of prints, the essential feature of this article being a useful contrasting of the conditions under which negatives and prints may be treated with advantage. In the first place, there must be a clear understanding as to the difference between true reduction and the mere removal of a general veil or fog, the latter operation being of special importance in relation to prints, as an amount of veil which may be of no practical importance in the case of a negative will sometimes ruin a print, as by reflected light a slight veil may completely mask a vigorous or fully gradated print. Further, a consideration of this subject will show that reducers which are excellent in the case of negatives may be useless for slightly veiled prints. The persulphate of ammonium is a case in point, as it does not sufficiently attack the faint deposit. Farmer's ferricyanide reducer, as also cupric chloride, ferric chloride, and cupric bromide, are excellent fog or veil removers in the case of negatives, but when used for prints are subject to the disadvantage that the faintest deposits of silver which remain take a yellowish tone, and sometimes the whole surface of the paper takes a yellowish tint. The general yellow tint which often arises when Farmer's reducer is used for prints may be removed by a sodium sulphite bath or by Belitski's alum and hydrochloric acid bath, but neither of these will remove the yellowish tint of the faint gradations of the true silver image. A fog-eliminating reducer not subject to this disadvantage is prepared as follows: Stock solution—Water, 100 parts; iodide of potassium, 10 parts; iodine, 1 part. From 2 to 5 c. c. of this liquid are added to 100 c. c. of water, and the positive print is immersed, when the fainter deposits become rapidly converted into silver iodide, and this salt must be removed by a hyposulphite bath, a 10 per cent strength being convenient. Ordinary papers are frequently sized with starch, and this will cause a general blue coloration, but this blue coloration disappears in the hyposulphite bath. Still, the blue coloration is an inconvenience, as it renders it difficult to judge of the progress of the reduction; hence, a more convenient all-round fog-removing reducer for prints is the following: Saturated solution of alum, 50 parts; 4 per cent thiocarbamide solution, 50 parts; glacial acetic acid, 1 part. The print being immersed in this bath, the dish is rocked until the reduction has sufficiently progressed, after which the print is washed.—Amateur Photographer.

## The Camphor Barometer.

A recent number of the weekly bulletin of questions and answers, published by the secretary of the French Association for the Advancement of Science, submits the following problem says The Monthly Weather Review:

How can we explain the formation of clouds, threads, and crystals that are produced in the so-called chemical or camphor barometer, which consists of a solution in alcohol of equal parts of three substances, the nitrate of potash, camphor, the hydrochlorate of ammonia, if the glass tube that contains this solution is hermetically sealed, and the variations of temperature to which it is subjected have no influence on the phenomenon?

This form of barometer is found everywhere in English-speaking countries under the names of "the farmers' weather glass," "the domestic barometer," or some other equally misleading title. In some forms that the editor has tested, there is scarcely any apparent change in the clearness of the liquid, year after year. In other instruments, the crystals of camphor assume different forms, from day to day, which are certainly very interesting to observe and study, but have nothing to do with the weather and storms, and even less than one would expect with the current temperature. To the meteorologist and farmer, these instruments have no value, but to the student of molecular physics, they are well worth an investigation.

The gas in the space above the liquid being a mixture of air and vapor of alcohol exerts a very variable pressure upon the liquid below; the latter is saturated with the three chemicals above mentioned, but as its temperature and pressure vary, it alternately rejects and absorbs a slight surplus of camphor. The rapidity with which this change takes place appears to decide the question as to the crystalline or fibrous structure of the visible cloud. Nearly all the changes in the appearance of the camphor cloud seem to depend upon the rate at which the changes of temperature take place, and the time that is given to the solid to collect into larger crystals and settle to the bottom or rise to the top, according to the relative density of different parts of the liquid. The ascending and descending currents going on within the liquid are slow and barely appreciable, but must have an effect upon its cloudy appearance.

THE projected ship canal from Georgian Bay to Montreal would mean the saving of 725 miles in the transportation of grain from Chicago to Liverpool; all but 29 miles is open river and lake waters.

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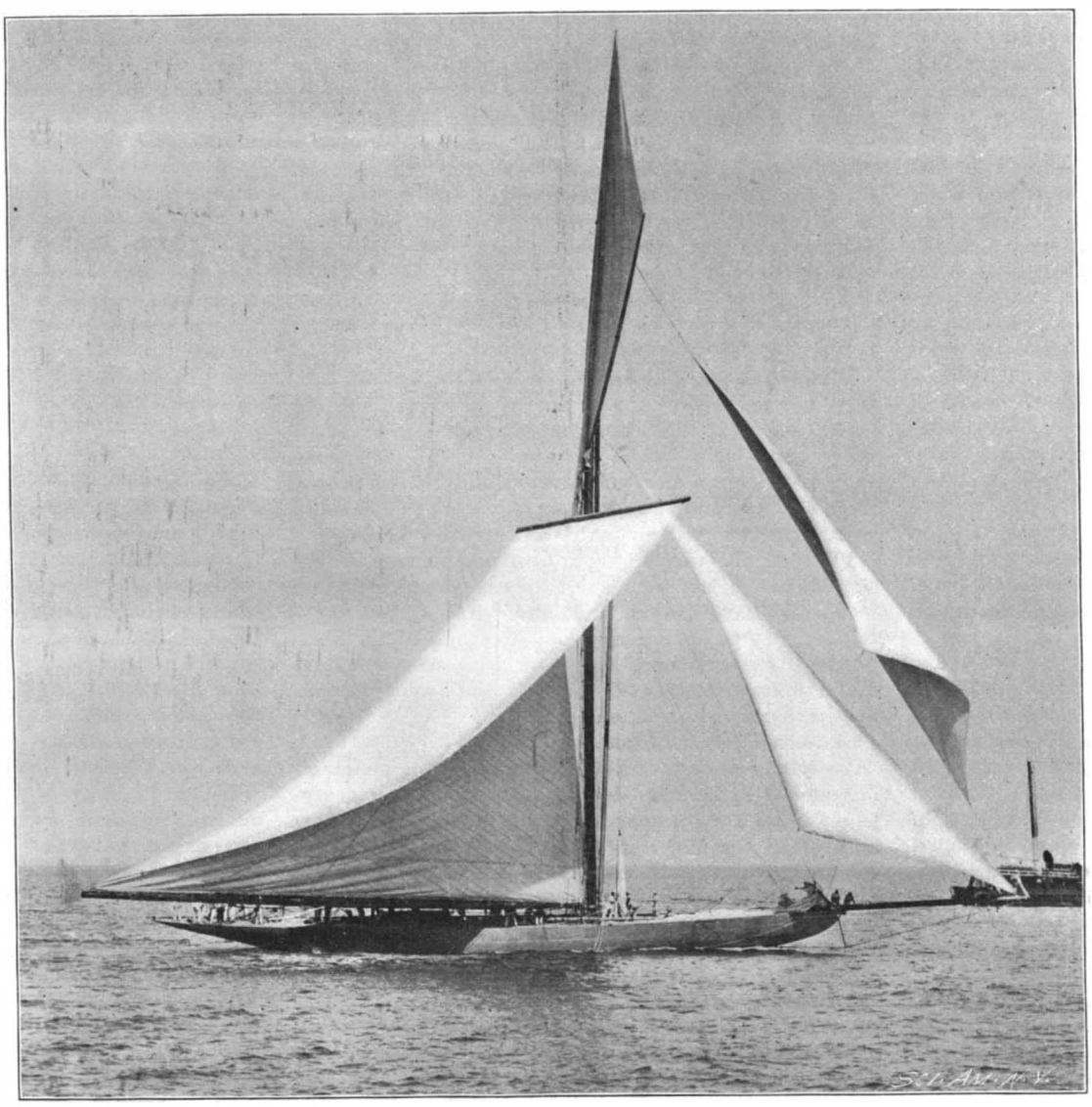
### THE "SHAMROCK" DISABLED.

A few weeks ago we presented an illustration showing the "Columbia" disabled off Newport during one of her tuning-up trials; and now it is the "Shamrock" that serves to "point a moral and adorn a tale." We suggested at the time of the "Columbia" mishap that in his desire to save weight aloft Herreshoff had probably ventured nearer to the limit of safety than was justified by the few seconds of time or fractional increase of speed secured thereby. "Columbia's" broken mast, however, was taken out and repaired in the Bristol shops, additional diaphragms and longitudinal stiffeners no doubt having been inserted at the point where it buckled. Let us at least hope so, for it would be a pitiful ending to all these months of preparation if the races should be won through the carrying away of spars or any other fortuitous causes.

The breakdown of the "Shamrock" happened on the very first trial of her new and large mainsail. At the time of the "Britannia" races, Sir Thomas Lipton stated that "Shamrock" was not carrying her full canvas, and promised a "surprise" when her racing canvas was spread in American waters. The "surprise" came when the 103-foot boom was unshipped and an immense spar of nickel steel, whose length is supposed to be 111 feet, was shipped in its place, the gaff being replaced by a hollow nickel-steel gaff of duly increased proportions. The new mainsail, unlike the first, had the cloths running from luff to leach, a type of sail which Ratsey the sailmaker said his firm had experimented with half a century ago and found wanting. Evidently he has discovered some positive advantages in the system, for there the sail was, with its cloths running square, instead of parallel with the leach or after edge of the sail. The object aimed at is to reduce the friction of the wind as it slides past the sail when the boat is close-hauled or on a close reach.

The "Shamrock" had just started in a light eight-knot breeze for a ten-mile run down the wind, with main boom swung to starboard and spinnaker set to port, when suddenly the hollow gaff buckled and bent into a sharp angle at the point where it was bearing against the shrouds. The peak at once dropped and allowed the mainsail to fall into the position shown in our engraving, the clubtopsail remaining aloft and assisting to give the yacht her curious and truly original appearance.

The accident illustrates a fact which is well known to bridge builders and all who have to do with framed structures involving the use of hollow built-up members: namely, that a hollow metal post or strut which is subject to great compressive strains (as in the case of a hollow gaff) will give way very quickly if a comparatively small bending strain be brought upon it. The enormous strain put upon a gaff by the pull of the peak halliards is largely resolved into a compression strain along the axis of the gaff, which accumulates in that portion of the gaff between the jaws and innermost point of attachment of the halliards. In running before the wind a bending strain was brought upon the gaff by its bringing up against the shrouds and spreader, with the result that it bent over like a boy's tin horn. That the accident should have happened in a light, eight-knot breeze suggests that in the matter of lightness of construction Fife has outheroded Herod, and makes one ask what will become of these spars in a blow. Solid wooden spars will give and bend before they break and afford some evidence that they are being strained to the breaking point, but there is no such ample warning in these hollow and largely unstiffened shells which do duty for spars in the modern racing machine. The experience of this season's cup races suggests that for topmast, gaff, and clubtopsail yards there is nothing to surpass a sound wooden spar.



"SHAMROCK" DISABLED.

A FEW years ago a western railroad planted 600 acres of land with trees, with the idea of growing timber for railway ties and telegraph poles. The trees have made good growth, but are not quite ready for use as poles, and some of the trees are now being cut out and made into fence posts in order to thin the forest.

### Bromide Enlarging.

It was quite a shock to me a few days ago—the beginning of August—to see the fall styles displayed in the windows of the dry goods stores. But so it is, summer is melting into autumn, and long evenings are coming. This means for many of us artificial light to work by, and a few remarks on bromide enlarging may be useful. For some of the hints which I give I am indebted to Mr. J. H. Baldock. The choice of the lens to be used is a matter usually decided by taking the lens which made the negative. This is a rough and ready rule, and one easily remembered. But if a wide-angle lens has taken the negative, it may be necessary to use a longer focus lens for the enlargement; it might be a good rule to have the focal length of the lens at least the diagonal of the enlargement. For light daylight is, of course, cheapest; and on a clear day with no clouds it is perhaps the best.

Illumination should be from the north or northeast, and a reflector placed at an angle of 45° should be used. Of course, care must be taken that the reflector is turned against clear sky—there must be no branches or buildings to interfere with even illumination. The distance between the negative and the lens, and the lens and sensitive bromide paper, will depend upon two things, i. e., the focal length of the lens to be employed, and the number of times the enlargement has to be. The next point for consideration, and it is a very important one, is the exposure, which is the one unknown quantity. Unfortunately, no hard and fast rule can be laid down to indicate what the correct exposure is, because it depends on so many factors, viz., the density of the negative, the degree of enlargement, the focal length of the lens, the intensity of the light, the sensitiveness of the bromide paper, and the size of the stop used. With reference to the second and fourth of these factors, must be borne in mind the rule that the intensity of the light varies inversely as the square of the distance from the source of light. But in practice this is comparatively simple and easy. A little experience with negatives of his own making will soon indicate to the worker the approximate exposure, and then by means of trial slips, pinned diagonally across the picture, so as to embrace, as far as possible, all the gradations, and exposing these slips for different times, say ten, twenty, forty, and eighty seconds, and developing the slips, it will soon be seen which of these times is the correct one. Indications will also be given as to whether any part of the negative requires shading, masking, etc., so as to stop exposure of certain parts, allowing a longer exposure to other parts. Of course, this can only be done when the image is projected onto an easel; it cannot be done if the enlargement is made in a camera.

Taking next development, bromide paper is not quite so amenable to development, as a compensation to errors of exposure, as are dry plates. Another thing, too, is that more light may be used with bromide paper than with dry plates; consequently, its development can be carried on with greater safety and comfort in working. There is a good choice of developers, but pyro cannot be used, on account of its liability to stain. I do not altogether recommend hydroquinone alone, though in conjunction with metol it forms a capital developer. Ferrous oxalate has always been a favorite, and is still largely used; but it is no good for under-exposed prints, and it requires the use of an acid fixing bath. With proper exposures it gives a brilliant, plucky, clear black image. Two good developerss are amidol and metol, either of which gives good black tones; they are easy to use, clean, non-staining, and can be used more than once. Amidol is used with pure and good sodium sulphite alone, while metol requires sodium carbonate in addition; either requires about two grains of potassium bromide to each ounce of developer. Should it be found that some parts of the print do not develop up by the time the rest of the picture is well out, pour off the developer, wash the print (with acid water if iron is being used), and then by means of a brush, or the tip of the finger, locally develop those parts which lag behind. In the case of clouds, tilt the dish, pour in a little developer, and try, by means of local work, to get detail in the sky. Finally, give the print or prints a good rinse, and fix them for about twenty minutes in the acid fixing bath, and then wash thoroughly for about two hours.

Next comes the question of clouds. If in a small picture the lack of clouds may sometimes prove fatal — and the introduction of clouds is essential—how much more necessary is it in the case of an enlargement, in which nothing looks worse than a vast expanse of white paper, supposed to represent the sky. Proceed as follows: Throw the image on an easel, and roughly cut out a cardboard mask, following the horizon line fairly correctly, but if trees or a church spire project into the sky, these may, as a rule, be disregarded, as they will print over the clouds. Having done this, select a cloud negative, soft and with not too pronounced effect, lighted from the same direction as the landscape, place it in the lantern, cap the lens, and make a trial exposure; having done this, pin up the enlargement paper, and make the necessary exposure on it, shielding the landscape portion with the already prepared mask, which must be kept moving, and as near the lens as possible. To soften the effect, and prevent the formation of a hard line, recap the lens, remove the cloud negative, and replace it by the landscape negative, the exposure necessary for which has been previously ascertained; uncap the lens and give this exposure, recap, remove bromide paper, and develop. You will probably find that a certain amount of local development has to be resorted to here.

There is sometimes a difficulty in mounting large bromide prints. When the print is pasted over it begins to curl, and when it is dry on the mount the whole thing cockles. I lay the mount on a table face downward and well dampen its back with a sponge. Then I lay the back of the print on the back of the mount and put them under slight pressure for a minute or two. This moistens the print just enough to let it lie limp when pasted, and the dampness of the back of the mount will counteract the strain of the paper in drying, and so the whole will dry flat.—Thomas Wood in Wilson's Photographic Magazine.

SOME of our Western railroads have been using weed burners to protect their tracks. One worked over 900 miles of track last year at a cost of $2.35 per mile. The speed is very slow, being only 1½ miles an hour, and a barrel of oil is used for each mile. Compressed air is forced through the oil, forming a vapor which is ignited. This vapor is kept close to the track by a shield over it. The intense heat burns the weeds between the rails. Once at work, the shield is lowered within four inches of the rail, and when not in use it is raised to eighteen inches above the rail.

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### Women in Science.

A complete treatment of this subject is to be found in a work by Rebière, "Les Femmes dans la Science," a second edition of which has just been published in Paris. In this edition Mr. Rebière has arranged in alphabetical order the names of all women who have publicly engaged in scientific work. From a brief résumé of this work by Senator Paolo Mantegazza, in Nuova Antologia (Rome), which The Literary Digest translates, we take the following data:

Maria Agnesi, at least for the Italians, is the most illustrious among women scientists. It was she who was called the oracle of seven languages. She was born in 1718 of noble parents. Among the letters of De Brosses we find the following description of a visit made by him to Agnesi: I entered into a grand and beautiful apartment, where I found thirty persons of all European nationalities in a circle about Signora Agnesi, who was seated under a canopy with her sister. She is a girl of eighteen or twenty years of age, neither plain nor beautiful, with a very sweet and simple air. The Count Bellini addressed a discourse in Latin to her, to which she responded with great vigor, continuing the discussion with him in the same language. She wrote a work on the theme that algebra and geometry are the only provinces of thought in which peace reigns. This was in two volumes, dedicated to Maria Theresa, and cost her ten years of work. It was for this that Pope Benedictus rewarded her by the gift of a rosary made of gems and a gold medal. Later he also called her as professor of mathematics to the University of Bologna. She afterward became a nun and died on the field of battle—that is, in her dear hospital—at the age of 81.

In 375, to Theon, professor of science in the celebrated school of Alexandria, a daughter was born. This was the distinguished Hypatia. It seems that in her early youth she went to Athens, where she attended the lessons of Plutarch the younger and his daughter, Asclepigena, who together directed the philosophical school. Leaving her country as a pupil, she returned as master, and the magistrates of Alexandria invited her to lecture in public. Later she taught mathematics and philosophy. She also taught geometry, algebra, astronomy, and several inventions are attributed to her, as the aerometer, planisphere, astrolabe, and the alembic. Her works were lost, but the historians attribute to her a commentary on the "Treatise on Conic Sections," by Apollonius; a commentary on the Arithmetic of Diophantus—the first algebraic works known; and an astronomical rule. No other woman has had greater glory. Beautiful, eloquent, with a voice which was called divine; honored, admired by all, Hypatia had many celebrated disciples, among them Synesius, who called her "my benefactress, my sister, my mother." After the most luminous glory came the most ferocious torture. At that time Alexandria was torn by religious strife, and three rival religions contested the ground—Judaism, Paganism and Christianity. In 415 she was dragged from her cart into the church of Cæsar, where she was stoned to death; then the poor limbs, lacerated and bleeding, were taken to Cinaron, the place of torture, where they were burned. We have no portrait of Hypatia, but all of us can imagine her with the luminous halo of a martyr to science.

Besides these two great stars, Hypatia and Agnesi, we can introduce a number of minor planets, all of whom revolved in the great heaven of mathematical and astronomical science. To Margaret Bryan, an English astronomer of the beginning of our century, we owe several works on astronomy, hydrostatics, etc.

Miss Clark is our contemporary. She was born in the south of Ireland, and is author of a "Popular History of Astronomy in the Nineteenth Century," which has already passed through several editions, and other astronomical works.

Maria Cunitz (1610–64), of Silesia, through her astronomical works published in 1650, merits her title of "the second Hypatia."

Sofia Germain, born at Paris in 1776, was said by Biot to be "probably the person of her sex who has most deeply penetrated into mathematics."

Caroline Herschel, sister of the great astronomer, passed entire nights with him observing the stars, aiding him most efficiently, and herself discovering comets. She died at the age of 98, in 1848.

Maria Margaret Kirch, born Winkelman (1660–1720), the wife of the astronomer, continued his work after his death, studying the skies. She published an important work on the conjunction of Jupiter and Saturn which took place in 1713.

Another illustrious woman astronomer is Dorothea Klumpke, born at San Francisco, who, after a splendid examination at the Sorbonne, became chief of the bureau for the photographic catalogue of the stars. She is a worthy rival of the celebrated Sofia Kowalevski, born at Moscow in 1853, who was the author of several famous mathematical works, made important discoveries in the science of the calculus, and was professor in the University of Stockholm, where she died in 1891.

Madame Lepante, the Greek astronomer, calculated the annular eclipse of the sun which took place in 1764, for entire Europe. It was a woman, a Miss Maury, to whom we are indebted for the discovery of the periodic revolution of some of the fixed stars, observed by her for the first time in the observatory of Harvard College.

Maria Whitney was the pupil of the great astronomer, Maria Mitchell. The latter was born in the island of Nantucket, and at the age of 29 had already discovered a new comet. In honor of this discovery the King of Denmark sent her a gold medal and her admirers gave her a magnificent telescope. At the age of 47 she was called to the chair of astronomy at Vassar College, where she afterward became director of the observatory. She died in 1889.

Among the professors at Bryn Mawr College we find Carlotta Angas Scot, born at Lincoln, England, in 1858, who is one of the best living mathematicians.

Everybody has heard of Maria Somerville, who died at Naples in 1872 at the age of 92. Lord Brougham, wishing to render popular that great work by Laplace, "Mécanique Céleste," which was in five volumes, requested Miss Somerville to place this in accessible form. "The Mechanism of the Heavens" appeared in 1831, and was such a perfect work that Herschel is said to have read it with admiration, and only regretted that Laplace no longer lived to admire it. Miss Somerville not only occupied herself with astronomy, but with physical science. Among other works she published a physical geography, which was translated into many languages and ran through many editions. Serene, tranquil, happy, it is said that she never studied more than two hours a day, and to this fact is ascribed her long life of almost a century.

In addition to those already mentioned, Senator Mantegazza calls attention to Laura Bassi, of Bologna (1711–73); Saint Hildegond (1100–86); Sofia Pereyaslawzewa, celebrated for her original observations in comparative anatomy; the French anthropologist, Clémence Royer, and others.

### Some Drawbacks to the Use of Acetylene.

BY PROF. J. VERTESS.

While coal gas has had to struggle for a whole century before becoming the almost universal lighting agent, its rival, acetylene, has already—after only a short time—achieved a certain success. Of course acetylene is not a newly discovered body, but it is only since the economic production of carbide of calcium that it has become practicable as a lighting agent.

Theoretically the production of acetylene is a very simple matter, but such is not the case practically.

Carbide of calcium, as is well known, is a black, crystalline, very hard material, not decomposed by heat, but easily decomposed by water into acetylene and lime. It has a density of 2·2, and it is not soluble either in petroleum or in benzine.

Concentrated acids have no action on it.

Acetylene consists of a colorless gas, with a penetrating odor of garlic. Its density is 0·1; 1 liter of acetylene weighs 1·16 grammes. It is easily soluble in water, and can be liquefied at 0° under a pressure of 48 atmospheres. In this state it is very explosive. It burns with a white flame, without a dark cone; the temperature of this flame is lower than that of coal gas.

Unfortunately, lighting by acetylene still presents numerous difficulties, to which I am desirous of calling the attention of specialists and others, now that I have had the opportunity of examining the installation which supplies the town of Veszprim in Hungary.

Let us first consider the carbide, the source of all the trouble. This body is never pure, but always contains at least 20 per cent of impurities. Theoretically, 64 parts by weight of carbide should give 26 parts of acetylene, that is to say, that 1,000 grammes of carbide ought to produce 406·25 grammes of acetylene; and, as 1 liter of this gas weighs 1·16 grammes, we ought to get 350 liters. But the Continental factories will not guarantee a return of more than 300 liters, and practical experience shows that we can hardly depend on more than 280 to 290 liters. It is true that the estimation of the return is not free from causes of error, inasmuch as during the weighing the carbide absorbs a certain amount of moisture from the atmosphere; this causes a loss of acetylene, but the small errors which result, when calculated on 1,000 grammes of material, are multiplied in proportion. We are obliged to work with small quantities, seeing that only 100 grammes of material give off 30 liters of gas, and it is difficult to arrange graduated gas-holders to store such large quantities. Further, the carbide is so little homogeneous that several samples must be tested and examined in order to obtain a mean value. If, on the other hand, we only take 10 grammes, the error resulting from the disengagement of acetylene in the air will be multiplied one hundred times if the results are calculated, as they should be, on 1,000 grammes. I have examined the manner in which the carbide behaves in the presence of acids, and I found that concentrated sulphuric acid has no action on this body; but, no matter how little water the acid may contain, bubbles of gas are formed until the whole of the water is consumed. This property of the carbide of not being attacked by concentrated sulphuric acid enables us to estimate its producing power of acetylene. I have made several experiments in this direction, and the results obtained were fairly correct and concordant.

I must here again mention that the carbide contains sulphur, phosphorus and nitrogen, from which it results that the acetylene will be contaminated with sulphureted hydrogen, phosphureted hydrogen and ammonia. The acetylene must, therefore, be purified to the same extent as is coal gas, for fear that its use in closed places might cause serious accidents.

But the greatest drawback of all is that acetylene burns with a smoky flame. Certainly the flame does not smoke at first, but after 200 or 300 hours smoke begins to be formed. This is caused by the burners attaining a temperature higher than that of the decomposition of the acetylene, and thus the gas is decomposed into carbon and hydrogen.

I have also noticed a very curious phenomenon in the gas pipes. I there found a deposit of finely divided carbon, like soot. I also found a very remarkable liquid condensation, consisting of carbides of hydrogen. These bodies are also formed in the generators, whence the necessity of using siphons. We thus see that it is quite erroneous to imagine that acetylene does not require purifying.

There is still another inconvenience resulting from impurities contained in acetylene. It is by no means uncommon to see, in a closed place, a sort of fog fill the room after a longer or shorter interval. What is the cause of this phenomenon? The acetylene is decomposed in the burner, the carbon is deposited while the hydrogen burns, giving rise to the formation of watery vapor; and it is this, in conjunction with the ammonia, the sulphureted hydrogen and the phosphureted hydrogen, which produces the fog, causing headache and nausea.—Chem. Zeitung, 1898, p. 174.

### The Climate Adapted to Tobacco.

In the report of the Virginia section for May, Mr. E. A. Evans, section director, gives a summary of our knowledge of the soil and climate adapted to raising tobacco. So far as climate is concerned, tobacco raising is profitable over a very wide extent of territory throughout the world. The range of climate that is found in the United States by no means exhausts the adaptability of the plant; in fact, with tobacco it is as much a question of soil as of climate. The climatic peculiarities of the regions in which the best tobacco is grown are not especially dwelt upon by Mr. Evans, but would make an interesting subject for study. The cultivated plant is evidently more susceptible to weather than the native tobacco of Virginia, and is, probably, the descendant of some variety imported by the early settlers, so that both soil and climate must be adapted to it. In general, the agriculturist labors to overcome the natural climate of any spot, and his resulting crop represents not the plant, or the soil, or the climate, but the intelligence of the skilled labor.

We hardly know how one should proceed in order to obtain botanical or agricultural material for a fair comparison between different climates as to their effect upon any given plant. The question of the relation between climate and crop belongs to the division of soils even more than to the Weather Bureau, since the meteorological climate must be considered in connection with the underground conditions. The roots have one climate, the leaves and the fruit have another; the crop results from a combination of both, with a very large admixture of agricultural skill.—Monthly Weather Review.

### The Current Supplement.

The current Supplement, No. 1238, contains many articles of great interest. "The East India Village in the Vienna Zoological Gardens" is described and illustrated. "The Nature of Valence" is an important chemical article by F. P. Venable. "The Use of Acetylene Gas for Street Cars, Street Lamps and for Automobiles" is described and illustrated. "Pulque, Mexico's National Drink," is an illustrated article. "Zoological Discoveries in Carthage" is the continuation of an article begun last week and describes the Punic necropolis. "Outline History of Brick Making" contains many curious facts. The "Blake," the first large cruiser of the British navy, is fully illustrated by sectional views. "Russia's Great Naval Enterprise" is an elaborate article. "The Catalogue of Science" gives particulars of the new schemes which are being made for an international catalogue of all scientific literature.

### Contents.

(Illustrated articles are marked with an asterisk.)


Acetylene, drawbacks to use of 204
American Association meeting.. 198
Barometer, camphor..... 202
Bridge destroyed by electricity.. 198
Bromide enlarging..... 203
Brooklyn Navy Yard, danger in approaches to the..... 194
Carbon, resistance of..... 198
Coast and geodetic survey vessel..... 197
Corn crop, new way to use the... 194
Cuba, financial problems of..... 194
Ebony of the ancients..... 196
Educational systems for young men..... 197
Fire fighter*..... 196
Fireproofing wood*.....193, 198
Forestry, government aid in..... 195
Fossil discoveries..... 196
Gold, moving..... 196
"Great Eastern" and the "Oceanic"*..... 202
Money spent by travelers..... 194
"Oceanic"*.....194, 200, 201
Peary, news of Lieut..... 195
Polaris, observations of..... 195
Porto Rico's hurricane*..... 200
Prints, reduction of..... 202
Roller bearing*..... 197
Rotary engine*..... 197
"Shamrock," disabling of*..... 203
Telegraphy, wireless, to report yacht races..... 194
Tire, vehicle*..... 197
Tobacco, climate adapted to..... 204
Twentieth century calendar..... 195
Wireless telegraphy during naval maneuvers..... 197
Women in science..... 204
Wood, fireproofing*.....193, 198


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## RECENTLY PATENTED INVENTIONS.

### Agricultural Implements.

STRAW-STACKER.—HERMAN STEIN, Georgetown, Minn. This straw-stacker can be applied to any thrashing-machine, and is so constructed that a current of air drawn from the outside of the stacker will be directed beneath the falling chaff and straw, thus facilitating the passage of the chaff and straw through the flue connected with the receiving-chamber and out through a chute connected with the flue. The chute is adjustable laterally or vertically, and is provided with a hood which directs the straw and chaff.

MACHINE FOR CLEANING GRAIN.—NORTON BROOKER, Agency, Mo. The machine is of the rotary type, and is adapted to discharge the chaff and bulky refuse from the tail end and to deliver the smaller seed and dust to a chute at the exterior of the reel into which the grain is fed, the good grain being retained in the reel and delivered automatically to outlets from whence it may be conducted to any desired point. Particular attention has been paid to the mechanical construction of the apparatus, so that its operation will be accompanied by no excessive friction.

### Electrical Apparatus.

AUTOMATIC CODE TELEGRAPH FIRE-ALARM APPARATUS.—RICHARD PEARSON, London, England. This invention is essentially concerned with the testing of the circuits upon which automatic fire-alarm instruments are installed, the purpose being to enable the whole of the alarm mechanisms upon the same circuit to be separately tested by momentarily closing a testing-circuit at the fire-engine station, so that personal inspection of the several installations is unnecessary. The test may be repeated at such frequent intervals as to insure immediate detection of any injury to the circuits or instruments.

### Mechanical Devices.

LOG-SAWING MACHINE.—SAMUEL W. BUTTERFIELD, Three Rivers, Canada. The machine is provided with a feeding device for the log and with a lever mounted to swing up and down under the control of the operator. In the free end of the lever a circular saw is journaled and adapted to pass transversely of the feeding devices. The end of the log abuts against a movable stop and is actuated from the lever. A movable block-kicker is normally held in a locked position and out of engagement with the front end of the log, the kicker being automatically unlocked by the lever at about the time the saw has passed through the log and the stop has been withdrawn to allow the kicker to move the cut-off block from the feeding device.

CYCLOMETER.—JAMES E. BEAN, Fond du Lac, Wis. The cyclometer is arranged to indicate simultaneously the number of miles traveled during the season and the number of miles of the individual trips made at the time. The mechanism comprises independent sets of numeral-wheels and a star-wheel adapted to be driven from the bicycle-wheel. The cyclometer is provided with a shaft carrying two pinions, each geared with a set of numeral-wheels. A worm engages one of the gear-wheels of the shaft and is driven by gearing from the star-wheel.

AUTOMATIC DEAD-LATCH LOCK.—W.G. RAINES, 148 West 125th Street, Manhattan, New York city. In dead-latch locks it is customary to provide a detent which drops behind some portion of the bolt to prevent its withdrawal after the door is closed, except by a key. This invention provides a peculiar construction and arrangement of the parts of a lock of this kind, which may be set into operative engagement by the departing person, thus rendering the locking-detent automatic, locking the latch as each person goes out, and yet permitting the door to be opened with a latch-key.

### Railway Appliances.

RAIL-JOINT.—GERMAN L. BAXTER, Lexington, Ky. It is the object of this invention to provide means for supporting the joint at the ends of the rails and to bind rails together in such a manner that the joint cannot be displaced, thus preventing the shock due to dropping of the joints. The rail-joint used is of the suspension kind and is provided with a cross-bar which engages the under sides of the rails.

### Miscellaneous Inventions.

THILL-COUPLING.—GEORGE W. DAVIS, Gilsum, N. H. The inventor has so constructed his thill-coupling that when the draft-animal is removed, the thills will be automatically carried up to a position of rest. The coupling permits the thills or shafts to be readily removed and replaced whenever necessary, and possesses the merit of being noiseless under all conditions of travel.

ACETYLENE-GAS GENERATOR.—ARTHUR RIEFFEL, Boulvard Exelmans 42, Paris, France. In this apparatus for the automatic production of acetylene gas, the column of feed-water for the gas-generating part of the apparatus is kept very much at the same height above the generator, and the water is fed intermittently and automatically to the gas-generator, according to the consumption, by means of a device which relieves the bell-shaped top of the gasometer when it descends and weights it when ascending, so that the top exercises on the gas a pressure which is inferior or superior to the load in the feed-water column.

BOTTLE-CLOSURE.—WILLIAM D. KILBOURN, Pueblo, Colo. The closure is designed particularly for bottles containing liquid under pressure, and comprises a hollow expansible stopper in which a plunger moves. The plunger is connected with an anchoring-piece from which arms extend having teeth and engaged by a clamping-ring. The closure is tightly held in place and hermetically seals the neck.

BLIND-FASTENER.—EDWARD HUGHES, New Bedford, Mass. This fastener is designed to be attached to a building so that the latch carried by the shutter will automatically effect a locking engagement therewith. The fastener will automatically exert tension between itself and the blind, when the blind is to be locked to a wall, thus preventing accidental closure. The fastener is provided with more than one keeper for the blind latch, thus enabling it to be used even should one keeper break.

LOCKING DEVICE.—HOSEA M. GODFREY, Lovell, Wyo. The present invention provides a locking device for use on singletrees, doubletrees, cockeyes, cranks and the like. The locking device has two parts, one of which is provided with a shank having an inner and outer lug, and the other of which is provided with a bore grooved to permit the passage of the shank. One face of the bored part has a shoulder for the inner lug to rest against in order to limit the turning of the shank in the bore.

HAND-SHIELD.—MELVILLE F. BARTH, Indianapolis, Ind. This hand-shield is designed to protect the wearer's hands while engaged in outdoor work or amusements, particularly in riding the bicycle. The shield may be manufactured of thin leather, silk fabric, canvas, or any other suitable material, and to suit the demands of the trade graded sizes are to be furnished to fit upon the hands of men, youths, or women.

GARMENT-SUPPORTER.—WILLIAM W. CARDER, Oldtown, Md. The supporter is especially adapted for hanging trousers and may be applied with equally good results to thick and to thin garments. The device is light and strong, is so constructed that the weight of the garment when the supporter is hung up will tend to increase the clamping action of the jaws of the device. The hanger will remain in a fully open position until intentionally closed.

UMBRELLA.—ELISA A. and EDWARD DE BIAGGI, Manhattan, New York city. The invention provides a means for preventing umbrellas from turning inside out in high winds and from being injured by contact with other objects while in use. The umbrella has a handle or stem on which a crown is rotatable provided with longitudinal slots in its upper portion. A cover is fastened to the crown; and upon the fastening means a washer rests having inward projections engaging the slots of the crown. A bell surrounds the slotted upper portion of the crown, engages the washer, and is prevented from moving longitudinally.

AMUSEMENT DEVICE.—GEORGE C. TILYOU and JEAN M. A. LACOMME, Coney Island, Brooklyn, New York city. The object of the invention is to attract and amuse people by the novelty of the sensations produced by the use of the device. The apparatus consists essentially of two concentric cylinders, the inner one being provided with seats and pivotally supported upon a shaft, so that it will remain in approximately the same position at all times, the center of gravity being below the shaft and the outer cylinder being mounted to turn about the inner cylinder. The device is provided with mechanism by which the seats within the inner cylinder are given vertical reciprocations.

MANUFACTURE OF MANTLES OR INCANDESCING ELEMENTS FOR GAS-BURNERS.—OTTO B. HEINZE, Baltimore, Md. The inventor has devised a process whereby incandescent mantles are practically rendered indestructible without impairing their illuminating quality, are rendered flexible and firm after ignition, and are prevented from shrinking when in use. The inventor thinly coats the surface of the refractory material of which the mantle or element is composed with a vitreous body and heats the mantle or element to fuse the coating with the refractory porous mass of the mantle or element.

RETOUCHING-FRAME.—JOHN N. CHOATE, Carlisle, Pa. A novel effect can be produced in retouching negatives by means of vibrations imparted to the negative itself instead of to the retouching-pencil or the hand of the retoucher. The present invention provides an apparatus for this purpose, comprising a frame and a clamp adapted to support the negative out of contact with the adjacent portions of the frame. A hammer is made to strike the clamp and thus impart vibration thereto and to the negative, independently of the frame.

HUNTING-KNIFE.—WILLIAM J. SHELTON, Columbia, Tex. It is the object of this invention to provide a knife with which a wire-cutter is connected, so as to render the knife useful in cutting through wire fences. The blade is formed with a recess in which a lever is pivoted formed with corresponding recesses. To the lever and blade, cutting-disks are secured having cutting-recesses. In cutting wire, the knife is placed with the cutting-edges of the disks embracing the wire; and the lever is pressed toward the handle of the knife to cut the wire. When one set of cutting edges becomes dull, another set may be brought into register with the proper recesses.

### Designs.

DRAINER.—COURTLAND HAYNES, Hawesville, Ky. The leading feature of the design is found in the especial shape of the drainer, in which the bottom is in the same horizontal plane throughout and the back is a straight line from side to side. The sides are parallel and straight from the back to a point near the front, from which point the sides gradually converge and meet a straight line defining the front of the drainer.

PLATE.—AUGUST A. GRAMETBAUR, Manhattan, New York city. The plate has a central panel containing a picture of Admiral Dewey. Surrounding the central panel are portraits of the commanders of the Manila squadron. The outer border of the plate contains pictures of the various vessels of Dewey's squadron.

LAP-ROBE.—MAGGIE B. SHOWEN, Macon, Mo. The principal characteristic of this design is found in widened portions flaring outwardly.

SPOON.—WILLIAM A. RAYMENT, Taunton, Mass. Two designs for a spoon have been issued to this inventor. In the one design the handle is bent or bowed back and under and has its extremity lapped against the inner side of the handle, near the juncture of the latter with the bowl. In the other design the handle is curved to return upon itself, with its free end lying below the upper portion of the handle and detached therefrom and from the bowl of the spoon.

SPOON.—WILLIAM MCAUSLAND, Taunton, Mass. The spoon is characterized by a handle returned or bent down, the portion below the bend being curved reversely.

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## INDEX OF INVENTIONS

**For which Letters Patent of the United States were Issued for the Week Ending**

**SEPTEMBER 12, 1899;**

**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]

Acid derivatives, making uric, F. Ach ..... 632,828
Adjustable seat, T. B. Mason ..... 633,021
Adjustable table, P. A. Congour ..... 632,804
Album with detachable pictorial post cards, J. Philipp ..... 632,788
Annealing furnace, wire, E. E. Douglass ..... 632,836
Anode, A. L. Walker ..... 633,056
Auger, hollow, J. Stephens ..... 632,764
Automobile, W. R. C. Corson ..... 632,805
Axles and journals, means for reducing friction of, W. J. Brewer ..... 632,693
Badge fastener, J. P. A. Petsch ..... 632,845
Bath apparatus, vapor, E. A. Butts ..... 632,802
Battery cell, voltaic, H. de Rufz de Lavison ..... 632,873
Bearing device, adjustable ball, E. W. McGuire ..... 632,878
Bearing, oscillating, H. B. Keiper ..... 633,096
Bearing, roller, P. M. St. Louis ..... 633,053
Bearing, shaft, B. E. Foss ..... 632,995
Bed and douche pan, D. Hogan ..... 633,004
Bed, folding metal, H. T. Dyett ..... 632,703
Bell, bicycle, T. Miller ..... 632,819
Bell, door, J. D. Ratliff ..... 632,824
Belt, conveyer, J. J. Ridgway ..... 632,750
Bicycle, T. W. Dixon ..... 632,807
Bicycle, G. Van Horn ..... 632,797
Bicycle lamp bracket, Waibel & Meytrott ..... 632,858
Bicycle packing case, W. Bylandt-Rheydt ..... 633,070
Bicycle pump, K. Buxbaum ..... 632,696
Bicycle pump, automatic, P. Hanson ..... 632,784
Bicycle rest, A. G. Shields ..... 633,046
Bicycle sled attachment, A. Nelson ..... 633,030
Bicycle support, E. E. Josef ..... 633,010
Bicycle support, H. H. Perkes ..... 633,036
Bicycle support and tire cleaner, Batten & Maul ..... 632,800
Bib, child's, C. A. Blank ..... 632,863
Blind slat rod, J. P. Kooy ..... 633,013
Blouse or waist and skirt and belt connector, M. Lang ..... 632,923
Boat adapted to operate on land or in water, J. P. Boulesque ..... 633,065
Boiler, R. W. Jacobs ..... 632,720
Boiler cleaner, mechanical, F. W. Hornish ..... 632,785
Boiler flue, tubular, A. Taggart, Jr ..... 632,951
Book, bank account, Wever & Parmerter ..... 632,769
Book, blank, F. H. Hertle ..... 632,941
Book, deposit and check, G. H. Rogers ..... 632,752
Bottle cork fastener, E. C. Akers ..... 632,981
Bottle filling machine, E. R. Klemm ..... 632,724
Bottle, non-refillable, J. Biesel ..... 632,956
Bottle, non-refillable, J. Creasy ..... 632,916
Bottle, non-refillable, S. P. B. Robins ..... 632,751
Bottle, paste, G. P. Cragin ..... 632,806
Bottle stopper, J. W. Dawson ..... 633,094
Brick for level floors and ceilings, etc., hollow, P. Rowald ..... 633,044
Bridge, W. L. Brayton ..... 632,985
Brush, Raymond & Beal ..... 632,748
Brush, clamping, Sell & Maynard ..... 632,793
Buckle, harness, J. A. Gavitt ..... 632,996
Buffer, Alma & Weiss ..... 632,688
Button, S. A. Koltonski ..... 633,097
Calendering machine, E. Gessner ..... 632,714
Call system, electric, H. M. Dumas ..... 632,964
Can body flanging device, A. Lotz ..... 632,840
Car coupling, J. Culton ..... 632,701
Car coupling, I. J. Hoyt ..... 633,086
Car coupling, W. L. Stonesifer ..... 632,904
Car coupling, Yeiser & Hancock ..... 632,861
Carbonating apparatus, J. Walter ..... 633,057
Card case, P. Hufeland ..... 633,006
Card clothing for fancy rolls, J. H. Crowther ..... 632,898
Carding machine condenser attachment, C. D. Ingraham ..... 632,871
Carpet fastening device, E. D. Berry ..... 632,911
Case. See Bicycle packing case. Card case.
Caster, J. W. Bateman ..... 632,774
Chain, watch, S. O. Bigney ..... 633,092
Chair, D. J. Bigelow ..... 632,832
Chair, H. W. Bolens ..... 632,775
Chair, S. W. Johnson ..... 633,087
Chairs, cradles, etc., automatic fan attachment for rocking, E. Griffitt ..... 633,001
Churn, G. A. Norcross ..... 633,100
Cigar vending machine, coin operated, G. Wilhelm ..... 632,798
Cigarette machine, F. E. Zschernig ..... 632,933
Cigarette making device, J. B. Popenhagen ..... 633,038
Cloth pressing machine, bed plate for rotary, D. Gessner ..... 632,837
Clothes drier, F. S. Grant ..... 632,999
Clothes line, pinless, J. R. Bolton ..... 632,889
Coal hod, ash sifting, L. St. Clair ..... 632,884
Coffin handle, F. Chillingworth ..... 632,914
Coins or checks, making bimetallic, G. G. Greenburg ..... 632,938
Collapsible seat and headrest, Kidd & Depue ..... 632,012
Comb cleaner, J. M. Black ..... 632,935
Concentrator, J. Woodham ..... 633,059
Conductors through conduits, clip for drawing, J. G. O'Brien ..... 633,067
Cork drawing device, H. E. Peterson ..... 632,742
Corset busk fastener, A. F. Chesney ..... 633,073
Coupling. See Car coupling. Thill coupling.
Covering for bodies impelled through water, J. O'Hara ..... 632,738
Cultivator, G. W. Noble ..... 633,033
Cup. See Invalid cup.
Currycomb, N. L. Lodahl ..... 632,730
Curtain fixture, A. J. Slack ..... 632,048
Curtain stretcher, H. A. Book ..... 632,867
Cycle chain adjusting device, H. Ganswindt ..... 632,711
Cycle steering apparatus, R. C. Ayton ..... 633,063
Damper mechanism for furnaces, time, M. I. Hain ..... 632,939
Dash pot and actuating cylinder, G. B. Petsche ..... 632,744
Dental forceps, M. B. McGhee ..... 632,843
Desk, writing, J. P. L. Nilson ..... 632,924
Door, F. J. Cronin ..... 632,700
Door catch, Norton & Hinkley ..... 632,946
Door check and closer, P. J. Lennart ..... 633,015
Door check; liquid, C. O. Case ..... 632,697
Door securer, W. E. & G. N. Crane ..... 633,078
Draught mechanism, P. Brown ..... 632,912
Draining rack, J. N. & J. T. Firth ..... 632,809
Dress shield, A. C. Squires ..... 632,883
Drier. See Clothes drier. Sand drier.
Drilling machine, portable, H. S. & C. E. Glenn ..... 632,921
Drum, heating, G. T. Hoff ..... 633,003
Drying apparatus, J. Howe ..... 632,943
Egg beater, H. T. Crepeau ..... 632,780
Electric brake, J. E. Williamson ..... 632,932
Electric fixtures detachable connection for, S. G. Read ..... 633,039
Electric indicator, F. B. Pope ..... 632,970
Electric lock, J. R. Francis ..... 632,868
Electric meter, E. Oxley ..... 632,739
Electric switches, automatic device for operating, I. Deutsch ..... 633,095
Electrical conductor conduit, M. O. Spring ..... 632,973
Electrode, M. Wuillot ..... 633,060
Elevating machine, hydraulic, S. L. Berry ..... 632,829
Enameling steel or homogeneous iron, W. F. & G. W. Niedringhaus ..... 632,737
Engine. See Explosive engine. Gas engine. Rotary engine. Rotary power engine. Rotary steam engine.
Engine and dynamo, combined, C. C. Cowan ..... 632,896
Engine and dynamo electric machine, combined, C. C. Cowan ..... 632,897
Engine controlling and regulating mechanism, T. H. Hicks ..... 632,716
Engine reversing gear, gas or petroleum, E. Petreano ..... 632,743
Engine stop mechanism, L. St. Peter ..... 633,090
Evener, three-horse, R. C. Harris ..... 632,869
Explosive engine, C. R. Daellenbach ..... 632,917
Explosive engine, J. Walrath ..... 632,859
Extracts, making nutritive, O. G. C. L. J. Overbeck ..... 632,968
Fabric. See Roofing fabric.
Fan, ventilating, H. L. Parker ..... 632,740
Farrier's knife, T. J. Pope ..... 632,846
Faucet, E. Randolph ..... 632,747
Feed water heater, steam boiler, M. N. Forney ..... 632,708
Fence machine, wire, A. B. Probasco ..... 632,746
Fence post, O. Andrew ..... 633,062
Fence post, J. S. Mullenix ..... 632,906
Fence spacing device, wire, J. T. Collins ..... 632,987
Fence, wire, G. C. Metcalf ..... 632,787
Fifth wheel, J. H. Gressom ..... 633,000
Filter, C. L. Holland ..... 632,870
Fire escape, L. A. Boehme ..... 632,692
Fire escape, J. H. Clinton ..... 632,893
Fire escape, E. P. Feiker ..... 632,993
Fire escape, F. Minster ..... 632,820
Fire extinguishing apparatus, H. F. Dunham ..... 632,702
Fish hook, J. E. Daugherty ..... 633,081
Fishing alarm device, H. Perrin ..... 632,823
Floor construction, R. D. Gallagher ..... 632,710
Flower pot, E. S. Williams ..... 632,978
Fluid compressor, C. F. & H. L. Schneider ..... 632,756
Fly paper, sticky, W. Thum ..... 632,927
Foot warmer, locomotive engineer's, M. McCune ..... 632,877
Furnace heat regulating attachment, C. P. Caldwell ..... 632,803
Gage. See Pressure or vacuum gage.
Game board, J. A. Crandall ..... 633,077
Game counter, R. J. Wilkens ..... 633,058
Garment stretcher, M. L. Spenard ..... 633,050
Garment supporter, M. S. Rodgers ..... 632,753
Gas burner, hydrocarbon, R. D. Cody ..... 632,894
Gas engine, S. A. Ayres ..... 632,888
Gas engine, F. Burger ..... 632,913
Gas engine, Hay & Builock ..... 632,814
Gas engine, H. Smith ..... 632,762
Gas engine, explosive, H. Smith ..... 632,763
Gas generating apparatus, acetylene, E. Henriquez ..... 632,940
Gas generating heater, hydrocarbon, C. Rutkoskie ..... 632,881
Gas generator, T. H. J. Leckband ..... 632,817
Gas generator, acetylene, F. A. Miller ..... 633,098
Gas generator, acetylene, W. F. Mudge ..... 633,027
Gas generator, acetylene, L. F. Rose ..... 633,043
Gas generator, acetylene, J. K. Rush ..... 633,045
Gas generator, acetylene, A. F. Schulz ..... 632,757
Gas heater, H. Adler ..... 633,061
Gas, making, H. Neumann ..... 633,031
Gate. See Railway crossing gate
Gate, G. Sommer ..... 632,853
Gearing, F. W. Mase ..... 632,875
Gearing, V. V. Torbensen ..... 632,886
Generator. See Gas generator.
Golf club, H. R. Sweny ..... 632,885
Grain, etc., automatic sampling apparatus for, C. Geissler ..... 632,713
Grain scouring machine, C. H. Bidwell ..... 632,831
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Harness, J. Reel ..... 633,041
Harrow, H. H. Burdick ..... 632,777, 632,778
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Heddles to shafts, means for attaching, K. Kurmann ..... 632,726
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Hinge, spring, A. Robinson ..... 632,850
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Hot plate, J. K. Smith ..... 633,049
House. See Smoke house.
Ice cream freezer, S. Sweeney ..... 632,856
Incandescent mantle support, L. Stiassny ..... 633,052
Indicator. See Electric indicator.

*(Continued on page 206)*

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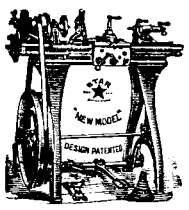

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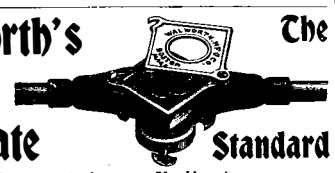

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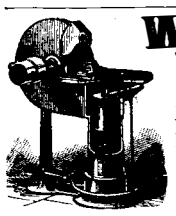

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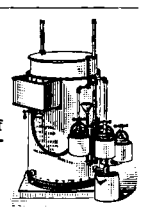

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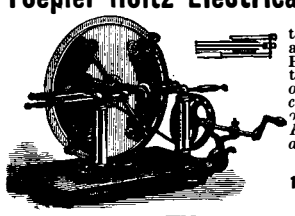

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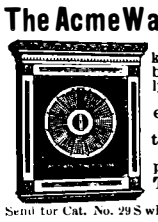

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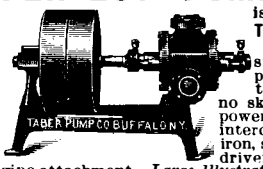

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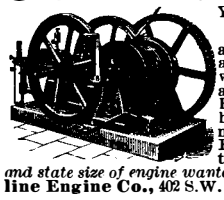

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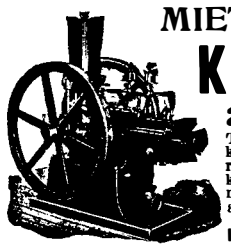

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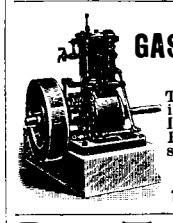

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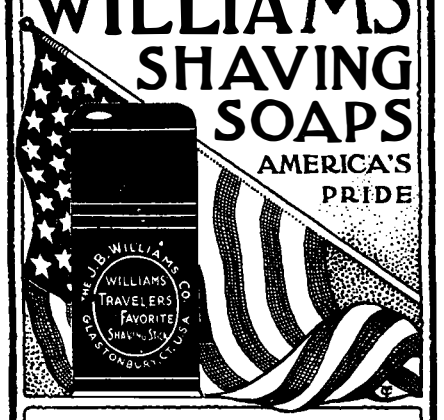


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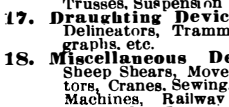

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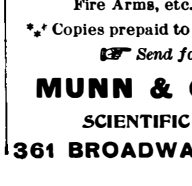

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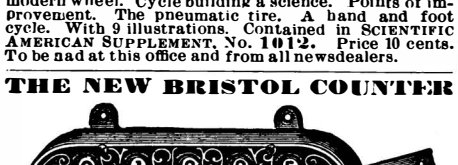


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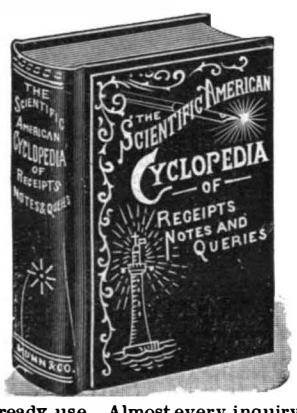


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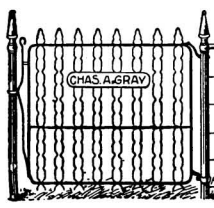


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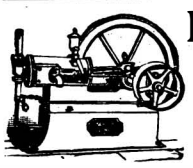

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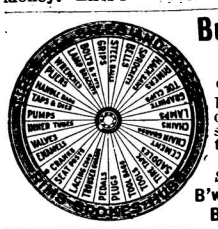

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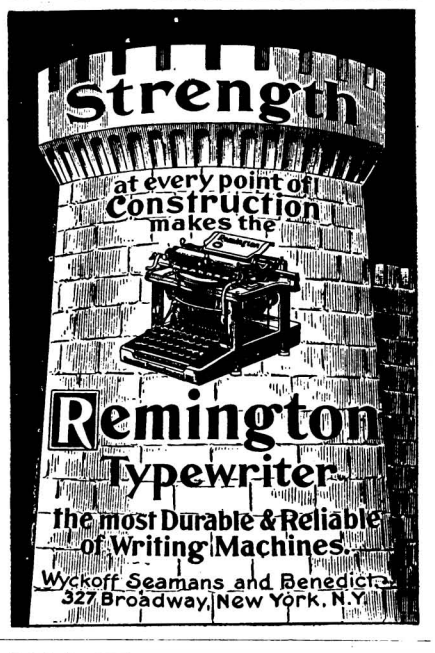


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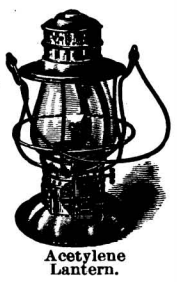

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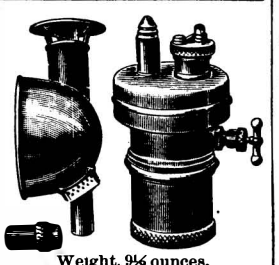

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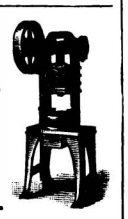

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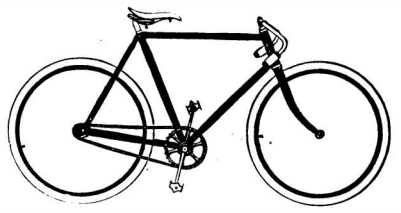

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